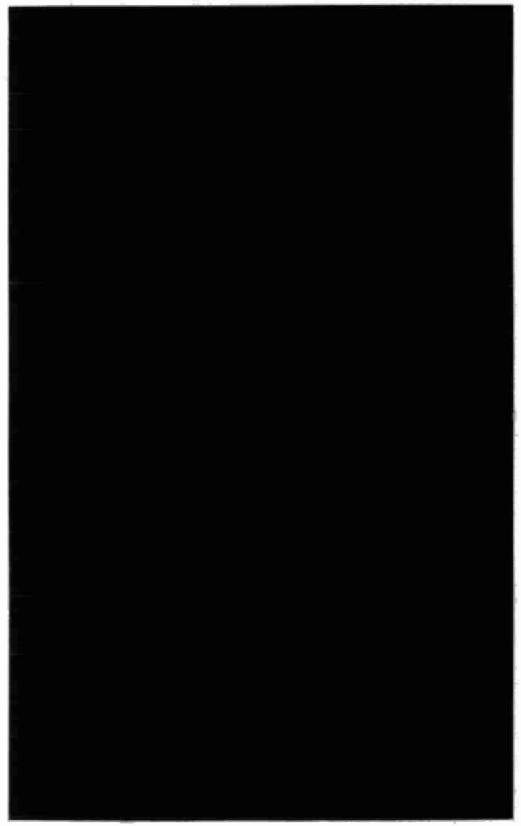
Environment Ontario

ENVIRONMENTAL RESEARCH

RESEARCH AND TECHNOLOGY BRANCH



ISSB 0836 - 1037

RESEARCH AND TECHNOLOGY BRANCH

ENVIRONMENTAL RESEARCH PROGRAM

INVENTORY OF RESEARCH AND DEVELOPMENT PROJECTS 1991

INVENTORY OF RESEARCH AND DEVELOPMENT PROJECTS

1991

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INTRODUCTION

The Ontario Ministry of the Environment, Research and Technology Branch publishes the annual **Inventory of Research and Development Projects** to ensure dissemination of research findings to the environmental scientific community. This reflects the Ministry's commitment to environmental research through effective allocation of resources, consistent with Ministry policies and priorities.

This Inventory presents summaries of Ministry funded research projects conducted in 1991. It includes both research grants and contracts awarded to universities, consultants, external research institutions, agencies, and internal research projects. The summaries are reported according to the sponsoring Committee, Branch or Region as follows:

- Research Advisory Committee
- Air Resources Branch
- Laboratory Services Branch
- Waste Management Branch
- Water Resources Branch
- Regions
- Ontario Pesticides Advisory Committee

The budget and resource information provided reflects only the originally approved allocations.

Additional project information may be obtained by contacting the principal investigator or the project liaison officer. Information concerning the Ministry's **Environmental Research Program** may be acquired by calling or writing:

Grants Assistant
Research and Technology Branch
Ontario Ministry of the Environment
135 St. Clair Avenue West, 12th Floor
Toronto, Ontario
M4V 1P5

Telephone: (416) 323-4649

RESEARCH ADVISORY COMMITTEE

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RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT: X	SOLICITED:	PROJECT NO: 296C
INTERNAL:	GRANT:	UNSOLICITED: X	START DATE: 11/86

PROJECT TITLE:
Slow Sand Filtration for Production of Drinking Water in Small Northern Communities

SHORT TITLE:
Slow Sand Filtration

PRINCIPAL INVESTIGATOR AND AFFILIATION:
W.J. Hargrave, P.Eng.
Gore & Storrie Ltd

LIAISON OFFICER (name,branch,section,address,telephone no.):
J.Dart
Water Resources Branch
P.O. Box 213, 125 Resources Rd
Rexdale, Ontario M9W 5L1

(416) 235-5816

OBJECTIVE(S):
To investigate the design, operation and maintenance of slow sand filtration for the treatment of drinking water in small northern communities.

PROJECT DESCRIPTION:
1. To assemble design, operation, maintenance and cost information on slow sand filtration through laboratory and on-side studies.
2. To evaluate simple chemical dosing systems, the potential colour removal, and to operate piolet test site.

Successful completion of the study will provide information on design and operation of slow sand filtration systems with particular reference to colour removal.

BUDGET AND RESOURCES:

YEAR: (* current)	4	5	6*	TOTAL
COST: ($000.s)				150.0

BUDGET SOURCE: RAC TOTAL YEARS: 6

KEYWORDS:
slow sand filtration, design, operation, maintenance cost, chemical dosing, colour removal

OUTPUT (papers, presentation, reports):
Paper presented at the Technology Transfer Conference, 1987

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL:	CONTRACT:	SOLICITED:	PROJECT NO: 298PL
INTERNAL: X	GRANT:	UNSOLICITED: X	START DATE: 03/86

PROJECT TITLE:
Method Development of PAH's in Ambient Air

SHORT TITLE:
PAH's in Ambient Air

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr. G. Diamond
Air Resources Branch

LIAISON OFFICER (name,branch,section,address,telephone no.):
Dr. N. Reid
Air Resources Branch
4th Floor, 880 Bay Street
Toronto, Ontario M5S 1Z8

(416) 326-1691

OBJECTIVE(S):
To develop a method of accurate sampling of airborne PAH compounds on a routine basis.

PROJECT DESCRIPTION:
This is a joint ARB-LAB-Regional Offices project. Various methods are being evaluated by both laboratory and field testing, to assess possible interferences, accuracy and precision.

BUDGET AND RESOURCES:

YEAR: (* current)	4	5	6*	TOTAL
COST: ($000.s)				30.0

BUDGET SOURCE: ARB Internal TOTAL YEARS:

KEYWORDS:
PAH, ambient air

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: 333G
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 04/87

PROJECT TITLE:
Slow Rate Infiltration Land Treatment and Recirculation of Landfill Leachate in Ontario

SHORT TITLE:
Recirculation of Leachates

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr. R.A. McBride
Land Resource Science
University of Guelph

LIAISON OFFICER (name,branch,section,address,telephone no.):
A. Oda
Waste Management Branch
Technology & Site Assessment
14th floor, 2 St Clair Ave West
Toronto, Ontario M4V 1L5

(416) 323-5129

OBJECTIVE(S):
1. To evaluate slow rate infiltration land treatment of leachate in forest/agricultural areas
2. To evaluate recirculation of leachate as partial treatment

PROJECT DESCRIPTION:
This is a three-year research study which will achieve the above objectives through the establishment of piolet-scale installations and the implementation of perturbation experiments at four sites across Ontario. Intensive characterization and monitoring of the more important biotic and abiotic ecosystem components will be carried out. Landfill recirculation will also be investigated as a means of pretreatment prior to slow rate infiltration land application, by lessening both leachate volume and strength .

BUDGET AND RESOURCES:

YEAR: (* current)	4	5	6*	TOTAL
COST: ($000.s)	171.2	147.8	128.4	447.4

BUDGET SOURCE: RAC TOTAL YEARS: 6

KEYWORDS:
leachate treatment, land application, recirculation, soil infiltration, irrigation (spray, trickle, sub-surface), effects on vegetation

OUTPUT (papers, presentation, reports):
Papers presented at the Technology Transfer Conference 1987 & 1988

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:
A Final Report has been received but it will be revised before publication

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL:	CONTRACT: X	SOLICITED:	PROJECT NO: 346C
INTERNAL: X	GRANT:	UNSOLICITED: X	START DATE: 11/87

PROJECT TITLE:
Development of Ambient Air Monitoring Methodologies for Dioxins and Furans

SHORT TITLE:
Dioxin/Air Monitoring

PRINCIPAL INVESTIGATOR AND AFFILIATION:
R. Clement, M. Lusis, P. Steer, C. Chiu, T. Dann (Environment Canada).

LIAISON OFFICER (name,branch,section,address,telephone no.):
Dr. Maris Lusis
Air Resources Branch
4th Floor, 880 Bay Street
Toronto, Ontario M5S 1Z8

(416) 326-1667

OBJECTIVE(S):
1) To validate and document design for filtration/sorbent hi-volume sampling and analysis of dioxins and furans in ambient air filter and PUF samples.
2) To utilize the development method for obtaining dioxins and furans data at selected locations and use the data to establish QA/AC procedures for air sampling and analysis.

PROJECT DESCRIPTION:
1) To review current activities including databases. 2) To evaluate air sampling and analysis procedures and carry out related intercomparison study. 3) To discuss the development technologies at a special workshop and apply them to specific areas. 4) To identify qualified laboratories capable of performing future work and their certification.
Successful completion of this project will provide the proponents with a state-of-the-art technology on dioxin and furans in air.

BUDGET AND RESOURCES:

YEAR: (* current)	1	2	3	4	TOTAL
COST: ($000.s)	30.0	45.0	10.0	30.0	115.0

BUDGET SOURCE: RAC/EC/BC TOTAL YEARS: 4

KEYWORDS:
Filtration/sorbent, QA/QC procedures, dioxins, furans

OUTPUT (papers, presentation, reports):
Paper presented at symposium on Measurement of Toxic Related Air Pollutants, North Carolina, 1988; 2 papers at Dioxin '89. 2 papers submitted to Chemosphere; Work shop proceedings in preparation; Consultant's Report "Review of Activities Centres of Expertise and Data Base for CDDs and CDFs in Ambient Air and the Pulp and Paper Industry".

EXTERNAL PARTICIPATION (ministries, governments, agencies):
Joint funding with the Province of B.C. and Environment Canada. Sponsored by CCME Research Advisory Committee.

COMMENTS:
Budget for year 4 carried over from year 3

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: 356G
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 02/88

PROJECT TITLE:
Development of a Hydrologic Model to Predict the Environmental Fate of De-icing Salts

SHORT TITLE:
Hydrologic Model/De-icing Salts

PRINCIPAL INVESTIGATOR AND AFFILIATION:
K.W.F. Howard
University of Toronto

LIAISON OFFICER (name,branch,section,address,telephone no.):
G. Soo Chan
Water Resources Branch
4th Floor, 1 St. Clair Ave West
Toronto, Ontario M4V 1K6

(416) 323-4890

OBJECTIVE(S):
To develop a hydrologic salt and water balance model that will predict, on a catchment scale, the long term environmental fate of many tens of thousands of tonnes of road de-icing chemicals applied annually to Ontario's highways, streets, paths and sidewalks. Essential features of this model include as follows: 1) It will be based on sound hydrologic principles and incorporate recent developments in our understanding of overland and shallow sub-surface contaminant flow processes (including mixing and ion exchange); 2) It will consider application of both Na and Ca, as well as Cl; 3) It will be developed our a specific catchment(s), but will be sufficiently versatile and flexible for use in other catchments; 4) It will predict long term chemical changes of both water quality in groundwaters, lakes and rivers; 5) It will be developed for ease of use with the eventual user in mind.

PROJECT DESCRIPTION:
The study is phased over 3 years and, while primarily desk oriented, will involve elements of field and laboratory investigation. Primary elements include: a) acquisition and critical assessment of all available and existing methodologies for catchment salt balance calculations; b) development of salt/water balance catchment model incorporating both new and existing technologies; c) selection of catchment suitable for model testing and calibration; d) acquisition of baseline data pertinent to selected study catchment(s); e) acquisition of additional input data through field and laboratory study, f) testing and calibration of new methods; g) preparation of final report.

BUDGET AND RESOURCES:

YEAR: (* current)	1	2	3	4*	TOTAL
COST: ($000.s)	31.9	33.4	33.4		98.7

BUDGET SOURCE: rac TOTAL YEARS: 3

KEYWORDS:
de-icing, environmental fate, hydrologic salt and water balance model

OUTPUT (papers, presentation, reports):
1989 Technology Transfer Conference: paper presented Hydrologic Model of De-Icing Salts in the Environment - A Salt Balance in an Urban Watershed.
1990 Technology Transfer Conference: Paper presented Geochemical Alteration of Road De-Icing Chemicals by Sub Surface Rock Soil Water Interaction

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:
final report will be completed by Dec. 1991

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: 386G
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 01/88

PROJECT TITLE:
Hamilton Air: Chemical Composition and Genotoxic Activity of Respirable Particulate and Organic Vapours.

SHORT TITLE:
Air Quality/Hamilton

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr. D. Macalla
McMaster University

LIAISON OFFICER (name,branch,section,address,telephone no.):
D. Corr
West Central Region
P.O. Box 2112
12th Floor, 119 King Street West
Hamilton, Ontario L8N 3Z9

(416) 521-7705

OBJECTIVE(S):
Determine what levels of airborne mutagenicity can be detected on respirable particles in the Hamilton airshed as a function of season and meteorological conditions. Determine if a simple mammalian index of genotoxic hazards can be developed using a post labelling technique which permits the quantitation of DNA adducts formed with activated carcinogens. Determine what chemical classes contribute to the mutagenicity of hamilton air. Determine how total airborne mutagenicity related to the air quality index.

PROJECT DESCRIPTION:
Preparation of reference samples by extraction of air particulate samples collected by D. Pengelly, et al. Fractionation of reference sample and characterization of fractions for mutagenicity in the Ames/Salmonella assay. Testing of mutagenic PAH fractions for DNA adduct formation using the 32P-postlabelling assay with bacteria and/or rabbit tracheal cells. Designation of tracers for source appointment. Initial collections of respirable air particulate samples from three locations in Hamilton.

BUDGET AND RESOURCES:

YEAR: (* current)	1	2	3	4*	TOTAL
COST: ($000.s)					130.0

BUDGET SOURCE: RAC TOTAL YEARS: 3

KEYWORDS:
airborne mutagenicity, respirable particles, air quality index, AMEs test, rabbit tracheal cells

OUTPUT (papers, presentation, reports):

TTC 1988 (November), presented: "Hamilton Air: Chemical Composition and Genotoxic Activity of Respirable Particulate and Organic Vapours".

TTC 1989 (November), presented: :Genotoxic Compounds Associated with Respirable Urban Air Particulate - Chemical Fractionation and Bioassay of Complex Mixtures".

Fifth International Conference on Environmental Mutagens: Symposium on Basic Mechanisms of Mutation. July 10-15, 1989. York.

University of Toronto, Ontario Poster Presentation. Increased Genotoxic Sensitivity of S. Typhimurium Strains to Nitro PAH Metabolism is Related to Enzymatic Activation and to Increased DNA Adduct Formation.

The Twelfth International Symposium on Polynuclear Aromatic Hydrocarbons. Gaithersburg, Md., September, 1989. Poster Presentation.

CHEMICAL FRACTIONATION AND BIOASSAY OF COMPLEX MIXTURES.

The annual meeting of the Environmental Mutagen Society, March 25-29, 1990; Alburquerque, New Mexico. Two poster presentations.

1) Genotoxic Compounds Associated with Respirable Particulate and Oil Emissions from a Tire Fire. Chemical Fractionation and Bioassay of Complex Mixtures.

2) Genotoxic Compounds Associated with Respirable Particulate and Oil Emissions from a Tire Fire. Chemical Fractionation and Bioassay of Complex Mixtures.

The Mutagenicity Gathering for Quebec and southern Ontario held at York University; May 31, June 1, 1990.

Rostrum Presentation: Mutagenicity of organic Associated with Urban Air Particulate.

Poster Presentation: Characterization of Sensitive Strains of S. Typhiumurium Used for Detection of Mutagens in Urbans Air Particulates.

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:
In progress

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT: X	SOLICITED:	PROJECT NO: 389C
INTERNAL:	GRANT:	UNSOLICITED: X	START DATE: 08/89

PROJECT TITLE:
Modelling Higher Moments of thew Concentration Probability Distribution (Concentration Fluctuations)

SHORT TITLE:
Concentration Fluctuations Modelling

PRINCIPAL INVESTIGATOR AND AFFILIATION:
E. Alp
Concord Scientific Corp.

LIAISON OFFICER (name,branch,section,address,telephone no.):
P.K. Misra
Air Resources Branch
4th Floor, 880 Bay Street
Toronto, Ontario M5S 1Z8

(416) 235-5768

OBJECTIVE(S):
Development of a state-of-the-art model for estimating concentration fluctuations (second moment).

PROJECT DESCRIPTION:
Literature review of available models and data, implementation of (a) selected mode(s) and testing against data; fundamental development work for enhancing the capabilities of the model, investigation of incorporation into the regulatory framework.

BUDGET AND RESOURCES:

YEAR: (* current)	1	2	3*	TOTAL
COST: ($000.s)	25.0	45.0		70.0

BUDGET SOURCE: RAC TOTAL YEARS: 2

KEYWORDS:
concentration fluctuation model, concentration probability distribution

OUTPUT (papers, presentation, reports):
Presentations at MOE Technology Transfer Conference

EXTERNAL PARTICIPATION (ministries, governments, agencies):
No direct involvement from other agencies except that some data are coming from the Alberta Energy Research and Conservation Board

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: 393C
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 04/88

PROJECT TITLE:
Measuring Groundwater Velocity and Hydrodynamic Dispersion in a Single Fracture in Fractured Shale

SHORT TITLE:
Groundwater/Hydrodynamics, Shale

PRINCIPAL INVESTIGATOR AND AFFILIATION:
J.A. Cherry
University of Waterloo

LIAISON OFFICER (name,branch,section,address,telephone no.):
G.Hughes
Waste Management Branch
14th Floor, 2 St. Clair Ave West
Toronto, Ontario M4V 1L5

(416) 323-5216

OBJECTIVE(S):
To investigate the relation between the fracture aperture width, 2b,determined from hydraulic tests and tracer experiments, and compare to the true aperture. Develop different field measurement techniques and evaluate for accuracy in predicting groundwater velocity. Determine the relation between the aperture density distribution and hydrodynamic dispersion. To determine whether a stochastic approach will be required to account for macroscopic hydrodynamic dispersion at the local field scale.

PROJECT DESCRIPTION:
The University of Waterloo, in a study funded by the Ontario Ministry of the Environment, has located and characterized high-permeability fracture zone in a low-permeability fractured shale. High-permeability zones such as these are common near ground surface in the shales of southern Ontario and can provide important pathways for contaminant migration. Recent evidence from the University of Waterloo study and other work has suggested that there is considerable uncertainty in the accuracy of predictions of groundwater velocity along such fracture plans. To investigate this, the University proposes to characterize the fracture zone at the Waterloo study site in considerably more detail and with a view to developing new hydraulic and tracer testing techniques for more accurately determining the parameters necessary for predicting groundwater velocity. To assess the newly developed and existing techniques, velocity predictions based on the results of the site characterization will be compared to the results of a natural gradient tracer experiment in which the actual groundwater velocity will be measured. In addition, physical inspection of the fracture plane surfaces will be undertaken to aid the comparison of results. As a result of the findings, the University hopes to provide recommendations or guidelines for the use of hydraulic testing techniques in fractured shale.

BUDGET AND RESOURCES:

YEAR: (* current)	1	2	3	4*	TOTAL
COST: ($000.s)	40.0	40.0	40.0		120.0

BUDGET SOURCE: RAC TOTAL YEARS: 3

KEYWORDS:
groundwater velocity, fracture plans, improved measurement, prediction

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:
In progress

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: 396G
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 04/88

PROJECT TITLE:
Tillage and Event Based Soil ans Phosphorus Loss

SHORT TITLE:
Soil/Tillage Systems

PRINCIPAL INVESTIGATOR AND AFFILIATION:
R. Kachanoski
Univeristy of Guelph

LIAISON OFFICER (name,branch,section,address,telephone no.):
J. Eddie
Water Resource Branch
4th Floor, 1 St. Clair Ave West
Toronto, Ontario M4V 1K6

(416) 323-4821

OBJECTIVE(S):
To determine the effect of tillage (conventional, minimum, no-till) on phosphorus/soil loss ans associated enrichment ratios for three representative soils (sandy, silt and clay loam). To determine seasonal variations in phosphorus and soil losses on different landscape positions with simulated rainfall. To determine annual phosphorus and asoil losses from soil landscapes for natural precipitation events. To establish linkages between plot scale and landscape scale phosphorus and soil loss data for different tillage systems.

PROJECT DESCRIPTION:
A study is proposed to obtain information on the seasonal variation of sediment and phosphorus loss for different tillages, landscape positions, and soil type combinations using rainfall simulation and natural presipitation events. The project will make use of existing tillage treatments and soil information being collected in the provincial Tillage-2000 program. Three tillage systems (conventional, minimum, and no-till) will be monitored on sand, silt and clay loam soils. Two rainfall intensities will be simulated. The project will compare seasonal; changes in sediment and P loss data from the microplots to an average annual value being estimated for the sites using cesium-137 as a natural tracer. The study will establish linkages between plot scale and landscape scale phosphorus anbd sediment loss data which can be used in an event based sediment transport model.

BUDGET AND RESOURCES:

YEAR: (* current)	1	2	3	4*	TOTAL
COST: ($000.s)	67.5	67.5	67.5		202.5

BUDGET SOURCE: RAC TOTAL YEARS: 3

KEYWORDS:
tillage systems, landscape positions, prexcipitation, phosphorus/soil loss

OUTPUT (papers, presentation, reports):
Progress Report August 1989. 2nd Progress Report May 1990

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: 400G
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 04/88

PROJECT TITLE:
An Integral Model Study of the Airborne Chemical Contaminants from Chemical Plants and Research Buildings: Their Detection, Identification and a Proposed Method for Their Evaluation

SHORT TITLE:
Airborne Contaminants/Model Study

PRINCIPAL INVESTIGATOR AND AFFILIATION:
C. Depew
Queen's University

LIAISON OFFICER (name,branch,section,address,telephone no.):
Dr. R. Chapman
Air Resources Branch
4th Floor, 880 Bay Street
Toronto, Ontario M5S 1Z8

(416) 326-1659

OBJECTIVE(S):
To establish an integral model on a total study of some airborne contaminants originated from typical chemical plants and laboratories in Ontario. The model will select two typical classes or air pollutants: nitrogen oxides (inorganic) and substituted aromatic and polyaromatic hydrocarbons (organic). The overall model study involves the establishment of sampling and detection procedures, and the development of a new method for the elimination of the contaminants from air.

PROJECT DESCRIPTION:
Document and review of existing sampling/detection technologies; defining procedures for air sampling from the exhaust air originating from the Queen's University research buildings. Proposals and design of a microwave-filtering devise/techniques for the removal/elimination of airborne contaminants from air samples collected and defined by previous studies.

BUDGET AND RESOURCES:

YEAR: (* current)	1	2	3*	TOTAL
COST: ($000.s)	33.1	33.1	37.8	104.0

BUDGET SOURCE: RAC TOTAL YEARS: 3

KEYWORDS:
chemical buildings, airborne contaminants, air filters, microwave catalyzed destruction, microwave chemical reactor

OUTPUT (papers, presentation, reports):
Two papers accepted for publication;
1. Journal of Microwave Power
2. Research on Chemical Intermediates
One presentation at the 11th Canadian Symposium on Catalysis, Halifax, July 1990. 18th Annual Southwest Ontario Undergrad. Student Chemistry Conference, Ryerson, March 1990.

EXTERNAL PARTICIPATION (ministries, governments, agencies):
None

COMMENTS:
Project complete, final report being revised

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: 405G
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 04/88

PROJECT TITLE:
Determination of the Dose-Responses for Tissue Contamination and Growth of Vegetable Crops Exposed to Chronic Levels of Organic Environmental Contaminants Originating from Industrial Processes

SHORT TITLE:
Organic Contaminants/Dose-Response Study

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr. Bev Marie-Hale
University of Guelph

LIAISON OFFICER (name,branch,section,address,telephone no.):
Mr. A. Kuja
Air Resources Branch
4th Floor, 880 Bay Street
Toronto, Ontario M5S 1Z8

(416) 456-2504

OBJECTIVE(S):
To establish bioaccumulation of trichloromethane and phenol through foliar exposure at concentration ranges including ambient standards using radish, lettuce and tomato. To establish bioacccumulation of trichloromethane and phenol through contamination of the root zone at a range of concentrations including ambient standards using radish, lettuce and tomato. To assess the relative importance of foliar and root exposure to bioaccumulation of these compounds in plant tissue, and establish partitioning indices as well as dose-response relationships between the two pathways of exposure and tissue accumulation. To assess the phytotoxicity will be evaluated by determining dose-response relationships between growth parameters and contaminant concentrations applied to the growth medium.

PROJECT DESCRIPTION:
The current emphasis on evaluating the environmental hazard of various phytoaccumulation and phytotoxicity exists for a few compounds and a small variety of plants, it is insufficient data to thoroughly predict the impact of industrial contamination an human dietary ingestion, and on growth processes of the plants themselves. Uptake by plants may occur via two pathways, foliar and root; the pathway may influence the eventual concentration of contaminants in edible portions, or the growth effects on different plant parts. The predominant pathway will depend on the medium which is contaminated, although in many situations both soil and air will be part of plant exposure. There is a need for an integrated study which evaluates the effects of chronic concentrations of several contaminants on three vegetables groups (root vegetables, leafy vegetables and fruit vegetables), by comparing the roles of the pathway of exposure on phytoaccumulation in various plant parts, injury and growth suppression. This research will lead to a better understanding of how industrial contaminants are partitioned in the terrestrial environment, leading to better human and eco-risk assessment.

BUDGET AND RESOURCES:

YEAR: (* current)	1	2	3*	TOTAL
COST: ($000.s)	46.4	30.9	30.9	108.2

BUDGET SOURCE: RAC TOTAL YEARS: 3

KEYWORDS:
bioaccumulation, radish, lettuce, tomato, foliar, root zone, partitioning indices, dose-response, phytotoxicity

OUTPUT (papers, presentation, reports):
Progress Report March 1989

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:
Final Report - Dec. 1991

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: 414G
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 04/88

PROJECT TITLE:
Flow Injection Sample Introduction for Inductively Coupled Plasma Atomic Emission and Mass Spectrometry

SHORT TITLE:
FIA for ICP

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Eric D. Salin
McGill University

LIAISON OFFICER (name,branch,section,address,telephone no.):
D. Boomer
Laboratory Services branch
P.O. Box 213, 125 Resources Rd
Rexdale, Ontario M9W 5L1

(416) 235-5858

OBJECTIVE(S):
To generate a sample introduction systems for trace level determinations with he following characteristics: 1) Detection limit improvements of at least a factor of 100. 2) Reduction or elimination of matrix effects, 3) Samples throughput of 30 to 60 per hour. 4) A chemical methodology suitable to a variety of samples types.
Secondary Objectives: 1) Automation of sample input using the direct sample insertion device for icp-aes and icp-ms. 2) Feedback from the instrument (or controller) to the sample introduction system so as to provide for intelligent modification of the experiment by either changing the chemistry (select different flow injection system parameters) or handling technique (e.g. standard additions or matrix matching) when justified by "expert" computer analysis if data. 3) Component speciation.

PROJECT DESCRIPTION:
A high performance sample introduction system based on flow injection techniques will be developed for inductively coupled plasma atomic emission and mass spectrometry. The system should provide detection limit improvement factors of 100 to 10,000 for atomic emission using direct insertion and from 100 to 1,000 for mass spectrometry using direct insertion. The detection limit improvements should be even more dramatic in cases where the matrix causes drastic degradation in detection limits. The flow injection procedure should minimize matrix effects thereby enhancing accuracy. Precision of approximately 1% is expected.

BUDGET AND RESOURCES:

YEAR: (* current)	1	2	3	4*	TOTAL
COST: ($000.s)	46.5	46.5	39.5		132.5

BUDGET SOURCE: RAC TOTAL YEARS: 3

KEYWORDS:
ICP, flow injection, ultra-trace, elemental analysis

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: 417G
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 04/88

PROJECT TITLE:
Wildlife Toxicology Fund Projects

SHORT TITLE:
Wildlife Toxicology

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Monte Hummel
World Wildlife Fund Canada

LIAISON OFFICER (name,branch,section,address,telephone no.):
J. Pagel
Ontario Hydro
800 Kipling Ave
Toronto, Ontario M8Z 5S4

(416) 231-4111 ext: 6279

OBJECTIVE(S):
Wildlife Toxicology Fund (WTF) was established on june 4, 1985 through a Memorandum of Understanding between Environment Canada and World Wildlife Fund Canada. Its purpose is to provide high quality scientific information that can be directly applied to the protection of Wildlife in Canada from irreversible harm caused by toxic chemicals in the environment, and to enhance and develop private sector expertise, and to act as stimulus for the joint funding of research projects. The objective of this proposal is to contribute $50,000 per year for up to three years to the World Wildlife Fund to fund on a cost share basis, projects which have been recommended for approval and cost sharing by WWF.

PROJECT DESCRIPTION:
The research priorities of WTF include: Effects of agricultural and or forestry chemicals on wildlife, effects of toxic industrial pollutants on wildlife, monitoring the success of measures taken to mitigate the effects mentioned in the above two priorities, developing and implementing techniques that use wildlife as indicators of toxic chemicals in the environment, examining environmental pathways by which toxic substances may affect wildlife. Proposals which meet the research priorities of the WTF and are recommended by RAC will be circulated to the Research Advisory Board of WTF. If approval is obtained from both committees, and if matching funds are in place, a specific amount of MOE's contributions will be released for the project.

BUDGET AND RESOURCES:

YEAR: (* current)	1	2	3	4*	TOTAL
COST: ($000.s)	50.0	50.0	50.0		150.0

BUDGET SOURCE: RAC TOTAL YEARS: 3

KEYWORDS:

OUTPUT (papers, presentation, reports):
"The Influence of Lake Acidification on Reproductive Success of the Common Loon in Ontario" 1989 Progress Report.

"Impact of B+ on Chicks of Spruce Grouse, Non-Target Insects and Small Birds and Mammals".

"Effects of Acid Precipitation on Waterfowl: Reproductive Effort of Common Golden Eyes in High and Low Quality Habitats."

"Metabolic Consequences of Environmental Acidification in Fish".

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: 418G
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 04/88

PROJECT TITLE:
Environmental Valuation Research

SHORT TITLE:
Environmental Research

PRINCIPAL INVESTIGATOR AND AFFILIATION:
J. Knetsch
Simon Fraser University

LIAISON OFFICER (name,branch,section,address,telephone no.):
O. Salamon
Policy and Planning Branch
11th floor 135 St Clair Ave West
Toronto, Ontario M4V 1P5

(416) 323-4561

OBJECTIVE(S):
To improve the basis for economic valuation of environmental changes; to investigate assessment and policy implications of the recent findings of large disparities between willingness-to-pay and compensation-demand measures of economic values; to study preference and choice behaviour of people with respect to alternative environmental policies; to examine various legal sanctions; and to further examine the development and use of economic experiments for research in these areas.

PROJECT DESCRIPTION:
The research will be carried out in a continuing series of individual experimental and survey studies, conducted in part in Ontario. The results of earlier studies will be used to design later empirical efforts, which will take full advantage of the large degree of complementarity among the individual studies. While the Principal Investigator will be responsible for the research, including studies in Ontario, it is anticipated that the Research Assistant and other colleagues will actively participate in expanding the research program.

BUDGET AND RESOURCES:

YEAR: (* current)	1	2	3	4*	TOTAL
COST: ($000.s)	24.9	24.5	26.0		75.4

BUDGET SOURCE: RAC TOTAL YEARS: 3

KEYWORDS:
benefit valuation, measuring, non=pecuniary values, willingness-to-pay, compensation-demand

OUTPUT (papers, presentation, reports):
Presentations at the 1988 and 1989 Technology Transfer Conference; Article published by the American Economic Review; "The Endowment Effect and Evidence of Non-Reversible Indifference Curves"

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:
In progress

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X | CONTRACT: | SOLICITED: | PROJECT NO: 421G
INTERNAL: | GRANT: X | UNSOLICITED: X | START DATE: 06/88

PROJECT TITLE:
Recycling of Dyebaths Effluents

SHORT TITLE:
Textile Dyebath Effluents

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Ann Wilcock
University of Guelph

LIAISON OFFICER (name,branch,section,address,telephone no.):
J. Smart
Waste Management Branch
14th Floor, 2 St. Clair Ave West
Toronto, Ontario M4V 1L5

(416) 323-5113

OBJECTIVE(S):
To test the efficiency of a new, commercially available electrochemical cell in the purification of environmentally hazardous textile dyebath effluents. These effluents contain expensive dyes and other chemicals that, if they can be precipitated from the effluent and reused, represent a substantial economic saving. The colorless supernatant will be tested for biological toxicity and for potential industrial recycling so that manufacturers will have the option of safely discharging the treated effluent to sewer or recycling it in industrial applications.

PROJECT DESCRIPTION:
To simulate the recycling of industrial dyebath effluent, an aqueous solution containing one of three common disperse dyes and a biphenyl carrier will be electrochemically separated into dye, carrier and water. The purity and potency of the recovered dyes and carriers will be tested by application to a polyester fabric. The water will be tested for toxicity by fish bioassay, and for reuse potential. The electrochemical separation system will then be tested in actual industrial conditions using disperse and other classes of dyes.

BUDGET AND RESOURCES:

YEAR: (* current)	1	2	3	4*	TOTAL
COST: ($000.s)	18.9	17.6	13.4		49.9

BUDGET SOURCE: RAC TOTAL YEARS: 3

KEYWORDS:
recycling, re-use, textile dye, toxicity

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:
In progress

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: 423G
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 01/88

PROJECT TITLE:
Chemical Exposure Pathways in Ontario

SHORT TITLE:
Chemical Exposure Pathways

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr. D. MacKay
University of Toronto

LIAISON OFFICER (name,branch,section,address,telephone no.):
J. Smith
Hazardous Contaminants Branch
12th Floor, 2 St. Clair Ave West
Toronto, Ontario M4V 1L5

(416) 323-5113

OBJECTIVE(S):
1) Establish correspondence between output of environmental model and prevailing concentrations in Ontario. 2) Establish a range of air inhalation and water and food consumption rates for a typical family in southern Ontario. 3) Develop correlations between concentrations in the environment and those in vegetation, fruit, meat, and dairy products. 4) Quality human exposure through ambient air, food and water. 5) Extend assessment to estimation of human physiological fate to chemicals through further development of existing pharmacokinetic model. 6) Validation of the set of models.

PROJECT DESCRIPTION:
A multi-media fugacity based environmental model estimates prevailing concentrations in various media such as air, water,soil, sediment, and fish has been developed and validated for a number of chemicals in southern Ontario. Concepts of this model will be extended to assess exposure to these and additional chemicals by a typical southern Ontario family through air inhalation and food and water consumption, as well as human physiological distribution and body burden. To qualify these exposures, it will be necessary to i) establish a range of typical food consumption rates, ii) develop expressions to correlate concentrations in soil, air, and water with those in vegetation, fruit, meat, and dairy products, and iii) refine and apply our recently developed pharmacokinetic model. Predicted exposures and body burdens will be compared with those known to cause toxic effects in order to assess their sensitivity.

BUDGET AND RESOURCES:

YEAR: (* current)	1	2	3	4*	TOTAL
COST: ($000.s)	49.5	43.5	43.5		136.5

BUDGET SOURCE: HCCB TOTAL YEARS: 3

KEYWORDS:
air, inhalation, fugacity,water, soil, sediment, fish

OUTPUT (papers, presentation, reports):
In press:

S. Paterson, D. MacKay "Modelling the Distribution of Organic Chemicals in Plants", proceeding of Intermedia Pollutant Transport: Modelling and Field Measurements, UCLA. Aug 23-26, 1988.

S. Paterson, D. MacKay, "A Model Illustrating the Environmental Fate, Exposure and human uptake of persistent Organic Chemicals", Ecological Modelling (in press 1989).

Submitted:

D. MacKay, S. Paterson "Evaluating the Regional Multi-media Fate of Organic Chemicals: A Level III Fugacity Model". Enviro. Sci. Technol.

S. Paterson, D. MacKay, "Review of Evaluative Models of Environmental Fate and human Exposure", Reviews in Environmental Toxicology (invited paper).

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:
In progress

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: 424G
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 08/88

PROJECT TITLE:
Monitoring Exposure and Effects of Organic Substances in the Huron-Erie Corridor

SHORT TITLE:
Organic Substances/Huron-Erie Corridor

PRINCIPAL INVESTIGATOR AND AFFILIATION:
D. Haffner
Great Lakes Institute, University of Windsor

LIAISON OFFICER (name,branch,section,address,telephone no.):
A. Hayton
Water Resources Branch
4th Floor, 1 St. Clair Ave West
Toronto, Ontario M4V 1K6

(416) 235-5800

OBJECTIVE(S):
There are five interactive subprojects: 1) To establish protocols for a statistically sound network of biomonitoring stations in the Huron-Erie corridor. 2) To determine foodweb exposure routes (water and/or in place pollutants). 3) To calibrate organisms of both the benthic and pelagic food chains in order to determine water and sediment concentrations. 4) To determine if bioaccumulation or bioconcentrations regulates residue levels in sport fish. 5) To establish vertebrate monitors to assess the impact of contaminants in the Huron-Erie corridor.

PROJECT DESCRIPTION:
Two sites will be set up along the Huron-Erie corridor to investigate temporal and spatial heterogeneity of contaminants in various media. Three times during the year food web transfers and community structure will be determined at two of the sites. Two benthic organisms will be calibrated to determine influences of sediment uptake. The MOE sport fish data base will be computerized. Impact studies initiated with collection and testing of natural populations. Spatial redundancy corrected by rejecting sites with no significant spatial variability. First foodwebs constructed. Breeding of both brown bullhead and bluntnose minnow populations will be initiated for mutagenicity studies.

BUDGET AND RESOURCES:

YEAR: (* current)	1	2	3	4*	TOTAL
COST: ($000.s)	200.0	200.0	200.0		600.0

BUDGET SOURCE: Environmental Services Div. TOTAL YEARS: 3

KEYWORDS:
contaminant-monitoring Huron-Erie corridor, toxicokinetics, biomonitoring, food chain

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: 427G
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 04/89

PROJECT TITLE: Behavioral Ecology of the Eastern Subterranean Termite in Ontario as a Basis for Control

SHORT TITLE: Termite Behavioral Technology

PRINCIPAL INVESTIGATOR AND AFFILIATION:
J.K.Grace
University of Hawaii
Dr. T.G. Myles
University of Toronto

LIAISON OFFICER (name,branch,section,address,telephone no.):
Geoff M. Cutten
Hazardous Contaminants Branch
12th Floor, 2 St. Clair Ave West
Toronto, Ontario M4V 1L5

(416) 323-5117

OBJECTIVE(S):
To describe the population demographics and foraging ecology of the eastern subterranean termite, Reticulitermes flavipes (Kollar), in southern Ontario by a systematic examination of colony growth and development, foraging patterns, intercolony interactions, chemically-mediated interactions with vegetation and fungi, and the effects of microclimate on colony development and foraging activities.

PROJECT DESCRIPTION:
Select, establish and map field sites. Develop wood extractions, fungal isolation, and bioassay techniques; and establish dye conditions for mark-recapture. Begin mark-recapture study, periodic field collections with evaluation of colony composition, microclimate measurements, and extraction/bioassay of insects, wood and fungi.
Complete seasonal mark-recapture study,continue filed collections with evaluation of colony composition, and microclimate measurements. PLC and GC separation of biologically active fractions from trees, associated fungi, and insects eliciting agonistic responses.

BUDGET AND RESOURCES:

YEAR: (* current)	1	2	3*	TOTAL
COST: ($000.s)	30.0	99.1	65.6	194.7

BUDGET SOURCE: RAC TOTAL YEARS: 3

KEYWORDS:
behaviour ecology, termites, control

OUTPUT (papers, presentation, reports):

Grace, J.K., & A. Abdallay. 1989. Evaluation of the dye marker Sudan Red 7B with Reticulitermes Flavipes (Isoptera: Rhinotermitidae). Sociobiology 15:71-77.

Grace, J.K. Northern subterranean termites. Peat Management

Grace. J.K. A modified trap technique for monitoring Reticulitermes subterranean termite populations (Isoptera: Rhinotermitidae). Pan-Pac. Entomol.

Grace, J.K. Habituation in termite orientation response to fungal semiochemicals. Sociobiology.

Grace, J.K., A. Abdallay, & K.R. Farr. Eastern subterranean termite foraging territories and populations in Toronto. Can. Entomol.

Grace, J.K.,& G.M. Cutten. Pulbic perceptions of termites control practices in several Ontario (Canada) municipalities. J. Environ. Management.

Grace, J.K., A. Abdallay. A short-term dye for marking eastern subterranean termites (Isoptera, Rhinotermitidae). J. Appl. Entomol.

Grace, J.K. Oral toxicity of barium metaorate to the eastern subterranean termite (Isoptera, Rhinotermitidae). J. Entomol. Sci.

Grace, J.K. 1990. Mark-recaputre studies with recticulitermes flavipes (Isoptera, Rhinotermitidae). Sociobiology 16: 297-303

Grace, J.K. 1989. Northern subterranean termites, Pest Managemnt 8(11):14-16.

Grace, J.K., A. Abdallay. 1990. A short-term dye for making eastern subterranean termites (Recticulitermes flavipes Koll., Isoptera, Rhinotermitidae). Journal of Applied Entomology 109: 17-75.

Grace, J.K. 1990. Oral toxicity of barium metaborate to eastern subterranean termite (Isoptera: Rhinotermitidae). Journal of Entomological Science 25: 112-116.

Zoberi, M.H., J.K. Grace. 1990. Fungi associated with the subterranean termite Recticulitermes flavipes in Ontario. Mycologia 82(3): (in press).

Zoberi, M.H., J.K. Grace. 1990. Ixolation of the pathogen Beauveria bassana from Recticulitermes flavipes (Isoptera: Rhinotermitidae). Sociobiology 16: 289-296

Grace, J.K. 1990. Behavioural ecology of subterranean termites and implications for control. In Current Research on Wood Destroying Organisms ans Future Prospects for Protecting Wood in Use (M.I. Haveerty & W.W. Wilcox, eds.). (In press).

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:
Final Report near is completion (09/13/91)

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: 429G
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 05/89

PROJECT TITLE:
Carcinogenicity Testing of Industrial Effluents Using a Rainbow Trout Assay

SHORT TITLE:
Carcinogenicity Testing/Industrial Effluents

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr. C.D. Metcalfe
Trent University

LIAISON OFFICER (name,branch,section,address,telephone no.):
Dr. Ian Smith
Water Resources Branch
6th Floor, 1 St. Clair Ave West
Toronto, Ontario M4V 1K6

(416) 323-4920

OBJECTIVE(S):
To develop a carcinogenicity assay using fish which can be used for monitoring of industrial effluents for carcinogenic activity. To fractionate extracts of carcinogenic effluents in order to identify classes of compound which warrant routine monitoring under MISA.

PROJECT DESCRIPTION:
To develop techniques for the preparation and fractionation of effluent extracts. To prepare extracts from representative industrial effluents (e.g. chlorination stage pulp and paper effluent, and to test these extracts for carcinogenicity using the rainbow trout assay protocols previously developed. To characterize the organic contaminants concentration of these extracts by analyzing (gas chromatography) for priority organic pollutants. To fractionate the effluents extract using column chromatography, and will test these fractions for carcinogenicity using the rainbow trout bioassay for mutagenicity in the AMES test, for induction of liver mixed function oxidases in trout and for indication of peroxisome in trout liver. We will also analyze the various fractions for priority organic pollutants in order to chemically characterize the extract fractions.

BUDGET AND RESOURCES:

YEAR: (* current)	1	2	3*	TOTAL
COST: ($000.s)	42.9	42.9	42.9	128.7

BUDGET SOURCE: RAC TOTAL YEARS: 3

KEYWORDS:
waste water management, carcinogenicity testing, rainbow trout assay, mutagenicity testing, effluent

OUTPUT (papers, presentation, reports):
1990 Technology Transfer Conference - oral presentation
1991 Technology Transfer Conference - oral presentation

EXTERNAL PARTICIPATION (ministries, governments, agencies):
Biohazards Laboratory MOE

COMMENTS:
Partial funding led to reduction in project scope. Approved by Liaison Officer June 27, 1989.

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: 432G
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 04/89

PROJECT TITLE:
Development of an Expert System for Automated Analysis of Metals

SHORT TITLE:
Development of ACexpert

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr. M.J. Stillman
University of Western Ontario

LIAISON OFFICER (name,branch,section,address,telephone no.):
Dr. J.C. Hipfner
Laboratory Services Branch
P.O. Box 213, 125 Resources Rd
Rexdale, Ontario M9W 5L1

(416) 235-5856

OBJECTIVE(S):
1) To develop a demo Expert System to fully control an AA for metal analysis;
2) To develop a generic Expert System to monitor and model quality control procedures used for data analysis;
3) Investigate use of an Expert System for technical personnel training.

PROJECT DESCRIPTION:
ACexpert is a very large expert system that comprises a number of interacting modules. Each module is itself a sophisticated expert system that carries out a specific task. ACexpert provides the link between the operation of these individual expert systems, the user, and the hardware that is used to complete the analysis. ACcontrol is the module that carries out all real-time instrument control functions, it includes an extensive CRT user interface and an expert system and data base management techniques. The base modules for ACexpert will be completed, following the design established during 1987. Further work on the modules that comprises that many expert systems in ACexpert will take place. The full system will begin to take shape, and the demonstration AAS unit will become available for real-time testing.

BUDGET AND RESOURCES:

YEAR: (* current)	1	2	3*	TOTAL
COST: ($000.s)	74.4	26.4	50.4	151.2

BUDGET SOURCE: RAC TOTAL YEARS: 3

KEYWORDS:
expert system, AA, metal analysis

OUTPUT (papers, presentation, reports):

Stillman, M.J.; Lahiri, S.; Zhu, Q. (1991) Design, constraints and implementation of rules within the multimodule expert system for trace metal analysis: ACexpert. Proceedings of the 2nd World Congress of Expert Systems.

Lahiri, S.; Zhu, Q; Stillman, M.J. "Expert systems in analytical chemistry. Design of a user interface and implementation of rules for ACdiagnosis within ACexpert." Proceedings of the 1990 Technology Transfer Conference., Ontario Ministry of the Environment, Toronto, Nov 19-20, 1990, Vol II, pp. 672-675.

Stillman, M.J.; Lahiri, S; Zhu, Q. "Design, constraints and implementation of rules within ACexpert." Proceedings of the 1990 Technology Transfer Conference., Ontario Ministry of the Environment, Toronto, Nov 19-20, 1990, Vol II, pp. 628-639

Browett, W.R.; Cox, T.A.; Stillman, M.J. (1989) Design of an expert system for automated metal analysis by atomic absorption spectrometry. In ACS Symposium Series, 408, 210-235.

Gasyna, Z; Browlett, W; Nyokong, T.; Kitchenham, R.; Stillman, M.J. (1989) Microcomputer-aided Chemistry. 5. Interactive computing for instrument control and data analysis in photochemical studies. Chemometrics and Intelligent Laboratory Systems, 5, 233-246.

Browett, W.R.; Stillman, M.J. (1989) Use of expert system shells in the design of ACexpert for automated atomic absorption spectrometry. Progress in analytical Spectroscopy, 12, 73-110.

Stillman, M.J.; Moussa, M. and Gasyna, Z. (1989) "Development of ACexpert. 3. Rules in ACdiagnosis and ACmethods." Proceedings of the Technology Transfer Conference, Toronto, 20 - 21 Nov, 1989, published by the Ontario Ministry of the Environment.

Stillman, M.J.; Cox, T.A.; and Browett, T.A. (1988) "Development of ACexpert. 2. Implementation of an expert system for automated metal analysis by AAS", Proceedings of the Technology Transfer Conference, Toronto, 20 - 21 Nov, 1989, published by the Ontario Ministry of the Environment.

Research Talks and Conference Papers, (1987 - 1991)

"Expert Systems in Analytical Chemistry", Special Symposium at the 74th National Conference of the Chemical Institute of Canada, June 1991. Invited Talk. Huang, G.; Stillman, M.J.; "design of GCMSexpert: "An expert system to aid in GC-MS data analysis"

Contributed talks: Lahiri, S; Stillman, M.J "Expert systems in analytical chemistry: Understanding rule generation in ACdiagnosis within ACexpert".
Zhu, Q; Stillman, M.J. "ACexpert: Design of a user interface"

Stillman, M.J.; Lahiri, S.; Zhu, Q "design constraints and implementation of rule within ACexpert." 1990 Technology Transfer Conference, Ontario Ministry of the Environment, Toronto, Nov 19 - 20 1990.

Lahiri, S; Zhu, Q; Stillman., M.J. "Expert systems in analytical chemistry. Design of a user interface and implementation of rules for ACdiagnosis within ACexpert." 1990 Technology Transfer Conference, Ontario Ministry of the Environment, Toronto, Nov 19 - 20 1990.

Stillman, M.J. "Emerging developments in computer techniques: Expert systems for use in analytical chemistry" Trace Analysis Symposium, Canadian Society for Mass Spectrometry, Nov 14 - 15, 1990. An invited lecture.

Lahiri, S; Stillman, M.J. "Development of expert systems in analytical chemistry", 8th Chemistry Graduate Student Symposium, SUNY at Buffalo, May 23-24, 1990.

Gasyna, Z.; Stillman, M.J. "Design of an expert system for an automated metal analysis by atomic absorption spectrometry", Pacifichem, Dec 17-22, 1989.

Stillman, M.J.; Moussa, M.; Gasyna, Z. "Development of ACexpert 3. Encoding rules for ACdiagnosis", Technology Transfer Conference, Ontario Ministry of the Environment, Toronto, 20 - 21 Nov, 1989.

Gasyna, Z.; Stillman, M.J. "Use of expert system techniques in the analysis of environmental samples", 10th Annual Meeting, Soc. Env. Tox. and Chemistry, Toronto, Oct 28 - Nov 2, 1989.

Stillman, M.J.; Cox, T.D.A.; Browett, W.R. "Development of ACexpert. 2. Implementation of an expert system for automated metal analysis by atomic absorption spectroscopy." 9th Technology transfer Conference (MOE), Toronto, Nov 29-30 , 1988.

Browett, W.R.; Cox, T.D.A.; Stillman, M.J. "ACanalyst: a real-time advisor for atomic absorption spectrometer control and analysis.", ACS National Conference, Los Angeles, USA, 25-30 Sept, 1988.

Cox, T.D.A.; Browlett, W.R.; Stillman, M.J. "Development of robotic sample handling and introduction into an atomic absorption spectrometer", The 3rd Chemical Congress of North America, Toronto, June 1988.

Invited Research Lectures:

Stillman, M.J. "Emerging developments in computer techniques: Expert systems for use in analytical chemistry", Trace Analysis Symposium, Canadian Society of Mass Spectrometry, November 14-15, 1990. An Invited Lecture.

"Expert systems in analytical chemistry", Special Symposium at the 74th National Conference of Chemical Institute of Canada, June 1991. Invited Talk.

"Developing ACexpert: The planning and prototype steps". DOW Chemical Canada, Analytical Laboratories, Sarnia, 7th Feb, 1990.

"Expert systems in analytical chemistry". XEROX Research Centre of Canada, Mississauga, 12th January, 1990.

"Expert systems in analytical chemistry". Department of Chemistry, University of Alberta, 20th July, 1989.

"Analysis of metals by atomic absorption spectrometry and inductively coupled atomic emission spectrometry", Southwestern Ontario Association of Clinical Chemistry, 22nd Dec, 1987.

"Application of computers in the laboratory for data acquisition and analysis", DOW Chemical Research Laboratory, Sarnia, Ontario Sept 1, 1987.

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:
This project is a continuation of that started under project #326PL

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: 433G
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 05/89

PROJECT TITLE:
Development of Multivariate Analysis Procedures for Ontario Air Quality Data

SHORT TITLE:
Multivariate Analysis of Air Quality

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr. P.K. Hopke
Clarkson University

LIAISON OFFICER (name,branch,section,address,telephone no.):
Dr. N. Reid
Air Resources Branch
4th Floor, 880 Bay Street
Toronto, Ontario M5S 1Z8

(416) 326-1691

OBJECTIVE(S):
To complete the development of three mode factors analysis to provide simultaneous temporal-spatial analysis of multisite air quality data. To compare the use of the Potential Sources Contribution Function (PSCF) for source identification of the acidic components of collected airborne particle samples with the results previously obtained for acidic precipitation. To examine the use of unsupervised pattern recognition methods as well as several other eigenvector methods to identify the interrelationships between the particle of precipitation composition variables and their relationship to the meteorological regimes that existed when the samples where taken.

PROJECT DESCRIPTION:
The Air Resources Branch has a number of on-going air quality monitoring programs that produce large multivariate data sets. The availability of state-of-the-art multivariate statistical analysis methods that will permit the maximum amount of useful information to be extracted from these data can aid the development and implementation of air quality management plans to maintain or improve the air quality in Ontario. This project combines the development of new methods that will provide improved analysis of the data and the testing of existing methods as to their utility to providing useful information from the air quality data that are available.

BUDGET AND RESOURCES:

YEAR: (* current)	1	2	3*	TOTAL
COST: ($000.s)	18.8	19.8	20.6	59.2

BUDGET SOURCE: RAC (US Funds) TOTAL YEARS: 3

KEYWORDS:
multivariate analysis, air quality data, Ontario, analysis procedures, acidic precipitation

OUTPUT (papers, presentation, reports):
Papers presented at the 1988,89,90 Technology Transfer Conference

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: 434G
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 05/89

PROJECT TITLE:
Investigations into the Analysis of Hydride-Forming Elements

SHORT TITLE:
Hydride Analysis

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr. I Brindle
Brock University

LIAISON OFFICER (name,branch,section,address,telephone no.):
Dr. J.C. Hipfner
Laboratory Services Branch
P.O. Box 213, 125 Resources Rd
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(416) 235-5856

OBJECTIVE(S):
1. The simultaneous analysis of the maximum number of hydride-forming elements with the lowest possible detection limit (of the order of 10-100 ppt).
2. Application of the above method to air filters.
3. Transferability of the hydride method to a continuous hydride generator for potential application as an interface to ICP-AES and ICP-MS.
4. Development of a preconcentration method for hydride-forming elements for potential application to surface waters and rain.

PROJECT DESCRIPTION:
The development of methods for the analysis of hydride-forming elements will be useful in acid rain studies and in studies related to toxic hydride-forming elements. Methods for the analysis of germanium and tin, developed during the first year of this study, by hydride generation will be applied to the analysis of arsenic and antimony will continue. The hydride-generation/interference reduction method for the analysis of selenium and tellurium will be investigated and attempts will be made to apply this to air filters. Optimum conditions will be determined for the simultaneous analysis of hydride-forming elements. Continuous hydride generation will be investigated with a view to interfacing the hydride system to either ICP-AES or ICP-MS systems. Methods for preconcentration of hydride-forming elements from surface water or rain will be developed.

BUDGET AND RESOURCES:

YEAR: (* current)	1	2	3*	TOTAL
COST: ($000.s)		46.8	44.8	135.9

BUDGET SOURCE: RAC TOTAL YEARS: 3

KEYWORDS:
analysis, hydride-forming elements, interferences, suppression

OUTPUT (papers, presentation, reports):
Ian D. Brindle and Xiao-chun Le, "D.C. Plasma Atomic Emission Spectrometry in Geochemical Applications" (Review), Geoscience Canada, Accepted for publication, June 1989.

Ian D. Brindle and Xiao-chun Le, "Application of Signal Enhancement by Easily Ionized Elements in Hydride Generation Direct Current Plasma Atomic Emission Spectrometric Determination of Arsenic, Antimony, Germanium, Tin, and lead", Analytical Chemistry, 1989, 61, 1175-1178.

Ian D. Brindle, Xiao-chun Le and Xing-fang Li, :Determination of Traces of Germanium by Hydride Genration - D.C. Plasma Atomic Emission Spectrometry. Interference Reduction by L-Cystine and L-Cysteine," Journal of Analytical Atomic Spectrometry, 1989, 4, 227-232.

Ian D. Brindle and Xiao-chun Le, "Determination of Traces of Tin by Hydride Generation - D.C. Plasma Atomic Emission Spectrometry. Interference Reduction by L.Cystine," 1988, The Analyst (London), 113, 1377-1381.

Charles Boampong, Ian D. Brindle, Xiao-chun Le, Lav Pidwerbesky, and Claudio Ceccarelli-Ponzoni, "Interference Reduction by L-Cystine in the Determination of Arsenic by Hydride Generation," 1988, Analytical Chemistry, 60, 1185-1188.

Hengwu Chen, Ian D. Brindle, and Xiao-chen Le, "Prereduction of Arsenic (V) to Arsenic (III), Enhancement of the Signal, and Reduction of Interferences by L-Cysteine in the determination of Arsenic by Hydride Generation." Submitted to Analytical Chemistry July 23, 1991.

Hengwu Chen, Ian D. Brindle, and Shaoguang Zheng, "A Novel *In Situ* Generator. Part 2: Stibine Generation Combined with Flow Injection for the Determination of Antimony in Metal Samples by Atomic Emission Spectrometry." Submitted to Analyst, (paper #1/02921E), June 14, 1991, accepted, pending revisions, August 11, 1991.

Ian D. Brindle, Hosen Alarabi, Xiao-chun Le, Shaoguang Zheng, and Hengwu Chen, "A New Design of an *In Situ* Separator for Continuous Hydride Generation. Part 1: Application to On-Line Prereduction of Arsenic (V) and Determination of Arsenic in Water by Atomic Emission Spectrometry." Submitted to Analyst, (paper #1/002915K), June 14, 1991, accepted, pending revisions, August 11, 1991.

Ian D. Brindle and Hengwu Chen, "The Effect Of Molybdenum (VI) on the Production of Arsine by the Tetrahydroborate (III) Reaction," Talanta, 1991, in the press.

Ian D. Brindle, Mary E. Brindle, Xiao-chun Le, and Hengwu Chen, "Preconcentration by Coprecipitation: Part I. Rapid Method for the Determination of Ultratrace Amounts of germanium in Natural Waters by Hydride Generation - Atomic Emission Spectrometry," Journal of Analytical Atomic Spectrometry, 1991,6, 129-132.

Ian D. Brindle and Xiao-chun Le, "A New Sample Introduction System for Direct Current Plasma Atomic Emission Spectrometry". Journal of Analytical Atomic Spectrometry, 1990, 5 559-562.

Ian D. Brindle and Xiao-chun Le, "Reduction of interferences in the Determination of Germanium by Generation of Hydride and Atomic Emission Spectrometry." Analytical Chimica Acta, 1991, 229, 239-247.

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:
Year 1 of project funded in 87/88 for 44.3 under project 360G.

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT: X	SOLICITED:	PROJECT NO: 441C
INTERNAL:	GRANT:	UNSOLICITED: X	START DATE: 07/89

PROJECT TITLE:
In Situ Biodegradation of Chlorinated Solvents as a Remedial Technology for Contaminated Groundwater

SHORT TITLE:
In Situ Biodegradation of Solvents

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr. D. Major
Beak Consultants Ltd.

LIAISON OFFICER (name,branch,section,address,telephone no.):
S. Emami
Water Resources Branch
4th Floor, 1 St. Clair Ave West
Toronto, Ontario M4V 1K6

(416) 323-4784

OBJECTIVE(S):
To determine factors and processes governing in situ transformation and degradation of tetrachloroethylene in the groundwater at a chemical transfer facility, thereby furthering understanding of microbial processes at spill sites.

PROJECT DESCRIPTION:
This study will involve conducting field and laboratory experiments to determine what factors and processes are governing the in situ transformation and degradation of tetrachloroethylene (PCE) in the groundwater at a chemical transfer facility. Available data suggests that PCE is being degraded biologically by the indigenous micro-organisms to less chlorinated intermediates which are in turn mineralized to CO2.

BUDGET AND RESOURCES:

YEAR: (* current)	1	2	3*	TOTAL
COST: ($000.s)	40.0	40.0		80.0

BUDGET SOURCE: RAC and Industry TOTAL YEARS: 2

KEYWORDS:
chlorinated solvents, contaminated groundwater

OUTPUT (papers, presentation, reports):
Presentation to supporting agencies and educational institutional institutors in early 1990.

EXTERNAL PARTICIPATION (ministries, governments, agencies):
Environment Canada, General electric, AT&T, C-1-6, Celenese

COMMENTS:
Final report is awaited - Environment Canada suppose to give funds to Beak Consultants.

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: 443G
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 05/89

PROJECT TITLE:
Ecology and Control of the Biofouler, Dreissena polymorpha, (Bivalvia: Dreissenidae), New to the Great Lakes

SHORT TITLE:
Ecology and Control of Zebra Mussels

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr. G.L. Mackie
University of Guelph

LIAISON OFFICER (name,branch,section,address,telephone no.):
Mr. P. Kauss
Water Resources Branch
4th Floor, 1 St. Clair Ave West
Toronto, Ontario M4V 1K6

(416) 323-4952

OBJECTIVE(S):
1) To determine life history characteristics of the Lake St. Clair populations of Dreissena polymorpha. 2) To determine the age and growth rate of individuals and of the population in Lake St. Clair and the extent of its distribution and growth rates in the Great Lakes. 3) To determine the potential impact of the zebra mussels on native species of unionid mussels in Lake St. Clair and some of its major tributaries.

PROJECT DESCRIPTION:
A major biofouler and nuisance organism, Dreissena polymorpha (Bivalvia: Dreissenidea) was discovered in the Great Lakes in Fall 1988. It is new to North America and nothing is known about its population dynamics and impact on other organisms, especially Bivalvia, in the Great Lakes, or indeed in any North American surface waters. Studies are described to determine the life history characteristics of D. polymorpha commonly called the zebra mussel, in Lake St Clair, its present growth rate and population age structure and its distribution in the Great Lakes and its potential impact of native species of unionid mussels endemic to Lake St. Clair and its major tributaries. The information on life history and distribution will be used to recommend to municipalities and industries measures to avoid infestations in domestic and industrial intake pipes. The study is a pre-requisite to a proposal submitted to the Wildlife Toxicology Fund for controlling infestations of zebra mussels in the Great Lakes.

BUDGET AND RESOURCES:

YEAR: (* current)	1	2	3*	TOTAL
COST: ($000.s)	31.5	29.9	25.1	86.5

BUDGET SOURCE: RAC TOTAL YEARS: 3

KEYWORDS:
Dreissena, polymorpha, biofouler

OUTPUT (papers, presentation, reports):
Resche, P. "Zebra Mussels" Seasons, (summer 1990), Federation of Ontario Naturalists.

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: 444G
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 05/89

PROJECT TITLE:
Groundwater Impact From Large Septic Systems for Sewage Disposal in Ontario

SHORT TITLE:
Large Septic Systems

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr. J.A. Cherry
University of Waterloo

LIAISON OFFICER (name,branch,section,address,telephone no.):
W. Blackport
West Central Region
P.O. Box 2112
12th Floor, 119 King Street West
Hamilton, Ontario L8N 3Z9

(416) 521-7703

OBJECTIVE(S):
To better understand contaminant attenuation processes in large septic systems and develop a method to predict the extent of aquifer contamination new large septic systems.

PROJECT DESCRIPTION:
About 20% of households in Ontario use septic systems, thus such septic systems represent the largest volumetric source of groundwater contamination, yet the magnitude of their impact is not known in Ontario, or elsewhere where septic system usage is also high. Previous studies by us during the past two years have shown that a single domestic septic system can produce an extremely large zone of contamination for non-reactive contaminants such as Na+ and NO3, but the biodegradable contaminants such as organics may be largely attenuated in the unsaturated zone above the water table, below the tile field. Large volume septic systems, may produce chemically different contaminant plumes due to higher dose rates resulting in reduces effluent residence time in the unsaturated zone. This study will: 1) investigate groundwater quality around two large septic systems in Ontario, 2) evaluate by field studies the effectiveness of alternative designs and/or effluent loading rates for minimizing groundwater contamination, 3) use mathematical models to evaluate on a more generic basis the implications with respect to groundwater protection of alternative septic system designs for achieving more favourable effluent loading rates, and better effluent attenuation.

BUDGET AND RESOURCES:

YEAR: (* current)	1	2	3*	TOTAL
COST: ($000.s)	65.0	65.0	65.0	195.0

BUDGET SOURCE: RAC TOTAL YEARS: 3

KEYWORDS:
groundwater impact, septic system effluents, contamination sewage disposal

OUTPUT (papers, presentation, reports):
Field Investigation of Septic Systems III, Long Point, Cambridge, Muskoka and Killarney Site 1989 (Feb 1990).

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT: X	SOLICITED:	PROJECT NO: 445C
INTERNAL:	GRANT:	UNSOLICITED: X	START DATE: 05/89

PROJECT TITLE:
Regional Low Flow Analysis for the Central and Southeastern Regions of Ontario

SHORT TITLE:
Regionalization/Low Flow Characteristics

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr. H.S. Belore
Cumming-Cockburn Limited

LIAISON OFFICER (name,branch,section,address,telephone no.):
Dr. L. Logan
Water Resources Branch
4th Floor, 1 St. Clair Ave West
Toronto, Ontario M4V 1K6

(416) 323-4989

OBJECTIVE(S):
1) To test available methodologies for predicting low flows in the Central and Southeastern regions. To identify suitable techniques for application and required research/refinements. 2) Develop an appropriate data base including additional parameters such as evaporation, groundwater fluctuations (well records). 3) Refine multivariate analysis techniques for predicting low flows. 4) Research to develop alternative computer based graphical low flow regional techniques.

PROJECT DESCRIPTION:
Many industrial and municipal dischargers are limited to specific concentrations of effluent based upon the extreme value low flow with various recurrence intervals for the receiving waters (needed for MISA program implementation). These extreme values are easily determined from historic data for gauged streams. However, ungauged streams are more commonly the receiving water and presently few estimation techniques are available. Therefore, this study will test available techniques from a previous study for the Southwestern/West Central regions and apply them to the Central and Southeastern regions. Then those preliminary techniques will be enhanced and new techniques will be investigated, developed and tested to provide methods for estimating extreme value low flows for ungauged sites in Central and Southeastern Ontario.

BUDGET AND RESOURCES:

YEAR: (* current)	1	2	3*	TOTAL
COST: ($000.s)	52.5			52.5

BUDGET SOURCE: RAC TOTAL YEARS: 1

KEYWORDS:
groundwater, Central and Southeastern Ontario

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:
In progress

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: 450G
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 05/89

PROJECT TITLE:
Standardized Rearing Materials and Procedures for Hexagenia, a Benthic Bioassay Organism

SHORT TITLE:
Hexagenia Rearing Materials and Procedures

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr. Jan J.H. Ciborowski
University of Windsor

LIAISON OFFICER (name,branch,section,address,telephone no.):
D. Bedard
Water Resources Branch
4th Floor, 1 St. Clair Ave West
Toronto, Ontario M4V 1K6

(416) 323-4930

OBJECTIVE(S):
Collection and cold-storage maintenance of genetically homogeneous Hexagenia egg stocks for distribution to laboratories on request. Synthesis of a standard aquatic sediment and diet from commercially available materials suitable for quickly rearing contaminant-free benthic aquatic invertebrates. Comparison of larval Hexagenia growth on natural (MOE bioassay control site) sediment with synthetic sediment. Assessment of factors contributing to variations in Hexagenia growth and body size. Assessment of influence of sediment-bound organochlorine contaminants on substrate preference, survival, development and bioaccumulation of Hexagenia larvae. Expansion of sediment/diet protocols to scales suitable for mass-culture of rapidly-growing contaminant-free bioassay test organisms.

PROJECT DESCRIPTION:
Realization of the importance of sediment-bound contaminants to transfer and retention parameters in aquatic systems has stimulated development of diverse research techniques. However, these techniques (toxicokinetics studies, bioassay procedures, field biomonitoring) suffer from lack of standardization in control sediments and availability of test animals. We will develop a synthetic sediment suitable for rapid growth of Hexagenia, a widely-used bioassay and biomonitor organism, for use in sediment-bioassay and biomonitor organisms, for use in sediment-bioassay trails and ecotoxicological studies. We will also develop rapid culture techniques for rearing contaminant-free organisms and determine methods of minimizing interindividual variations in development: factors that reduce the power to detect effects in bioassay and toxicokinetic studies. Additionally we will maintain egg stock from a single population and make material available to other laboratories to assist in maximizing comparability of ecotoxicological research.

BUDGET AND RESOURCES:

YEAR: (* current)	1	2	3*	TOTAL
COST: ($000.s)	22.8	25.5		48.3

BUDGET SOURCE: RAC TOTAL YEARS: 2

KEYWORDS: Hexagenia, benthic bioassay organisms,

OUTPUT (papers, presentation, reports):
1. Hanes, E.C., S.S.H. Ciborowski and L.O. Corkum. 1990. A Standardized Rearing Materials and Procedures for Hexagenia, a Benthic Aquatic Bioassay Organism. Annual Report Prep. for RAC, MOE,. June 1990. 45p.

2. Hanes, E.C., S.S.H. Ciborowski and L.O. Corkum. 1990. A Standardized Rearing Materials and Procedures for Hexagenia, a Benthic Aquatic Bioassay Organism; Comparison of Sediment Types. Proc. 1990 MOE, Technology Transfer Conference, Toronto. Vol. I: 374-387.

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:
In progress

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT: X	SOLICITED:	PROJECT NO: 452C
INTERNAL:	GRANT:	UNSOLICITED: X	START DATE: 08/89

PROJECT TITLE:
Multispectral Remote Sensing Technologies for Past, Present and Future Mapping of Chlorophyll

SHORT TITLE:
Chlorophyll Remote Sensing

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Mr. Arunas R. Kalinauskas
Moniteq Ltd.

LIAISON OFFICER (name,branch,section,address,telephone no.):
Dr. N. Hutchinson
Water Resources Branch
Bellwood Acres Road
Dorset, Ontario P0A 1E0

(705) 766-2412

OBJECTIVE(S):
1) Simulate Landsat MSS and Landsat TM data using Programmable Multispectral Imager (PMI) data and correlate the simulated Landsat data with OME chlorophyll samples collected near simultaneously with the imagery. This correlation can than be used for historical, present and future deviations of chlorophyll concentrations from the Landsat series of satellites.

PROJECT DESCRIPTION:
Landsat TM and MSS data will be simulated from archived PMI data which was collected co-incident with OME chlorophyll and water quality sampling in the Lake of the Woods. Moniteq will develop a methodology, to correlate the simulated Landsat imagery with the chlorophyll sampling for use in mapping past, present and future chlorophyll samples from Landsat imagery. A second methodology will be developed to create and test an optimized spectral bandset for remote chlorophyll mapping. Again the candidate bandsets for evaluation will be synthesized from the archieved PMI data. The optimized chlorophyll mapping bandset will be available for use in state-of-the-art remote sensors for airborne mapping of chlorophyll.

BUDGET AND RESOURCES:

YEAR: (* current)	1	2	3*	TOTAL
COST: ($000.s)	41.9	7.2		41.9

BUDGET SOURCE: RAC TOTAL YEARS: 2

KEYWORDS:
multispectural remote sensing, chlorophyll, mapping, water quality

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):
OMNR-Lake of the Woods Fisheries Unit , Ontario Centre for Remote Sensing, Advice and Transportation

COMMENTS:
This is a research component of a WRB project to investigate factors responsible for increased frequency and intensity of algal blooms in Lake of the Woods, Ontario.

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: 453G
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 08/89

PROJECT TITLE:
New Methods for Rapid Sample Digestion

SHORT TITLE:
Rapid Sample Digestion

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr. Eric D. Salin
McGill University

LIAISON OFFICER (name,branch,section,address,telephone no.):
D. Boomer
Laboratory Services Branch
P.O. Box 213, 125 Resources Rd
Rexdale, Ontario M9W 5L1

(416) 235-5858

OBJECTIVE(S):
The objective is to develop a system which will process batches of samples. The process involves microwave digestion of the samples while they are in a tube. The results should be a system which digests samples much faster and with minimal hazard.

PROJECT DESCRIPTION:
The development of an automated flowing stream microwave digestion in proposed based on the grantee's preliminary work described at the 1988 MOE Technology Transfer Conference.

BUDGET AND RESOURCES:

YEAR: (* current)	1	2	3*	TOTAL
COST: ($000.s)	20.0	20.0		40.0

BUDGET SOURCE: RAC TOTAL YEARS: 2

KEYWORDS:
microwave digestion

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:
In progress

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT: X	SOLICITED:	PROJECT NO: 454C
INTERNAL:	GRANT:	UNSOLICITED: X	START DATE: 07/89

PROJECT TITLE:
Standard Reference Materials for Trace Organic Analysis of Aqueous Environmental Samples

SHORT TITLE:
Standard Reference Materials for Trace Organic Analysis

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Mr. J.A. Coburn
Zenon Environmental Inc.

LIAISON OFFICER (name,branch,section,address,telephone no.):
Dr. D. Bell
Laboratory Services Branch
P.O. Box 213, 125 Resources Rd
Rexdale, Ontario M9W 5L1

(416) 235-5910

OBJECTIVE(S):
To conduct a comprehensive critical literature review of the preparation of standard aqueous solutions of highly hydrophobic materials, such as dioxins, organochlorine pesticides and polychlorinated biphenyls. Submit a copy of this to the Drinking Water Organic Section. To prepare a number of generator columns for these hydrophobics, calibrate them and deliver these columns with appropriate certificates to the Drinking Water Organic Section.

PROJECT DESCRIPTION:
A comprehensive and critical literature review of published solubility data for selected classes of environmentally hazardous hydrophobics of low solubilities. The various methods for the preparations of labelled compounds should be reviewed as well. To include computerized searching of Chemical Abstracts, data bases, NTIS reports, manual journal searches and personal contracts with other workers in related areas.
1) Dioxins, 2) PCB's, 3) Organochlorine Pesticides

BUDGET AND RESOURCES:

YEAR: (* current)	1	2	3*	TOTAL
COST: ($000.s):	28.0	16.0		44.0

BUDGET SOURCE: RAC TOTAL YEARS: 2

KEYWORDS:
aqueous environmental samples, standard reference materials, Trace Organic Analysis, SRM, PCB, dioxins, generator columns

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:
In progress

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT: X	SOLICITED:	PROJECT NO: 456C
INTERNAL:	GRANT:	UNSOLICITED: X	START DATE: 06/89

PROJECT TITLE:
Retractable Absorbents for Environmental Clean Up

SHORT TITLE:

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr. Anthony Redpath
Ecoplastics Ltd.

LIAISON OFFICER (name,branch,section,address,telephone no.):
Dr. Otto Meresz
Laboratory Services Branch
P.O. Box 213, 125 Resources Rd
Rexdale, Ontario M9W 5L1

(416) 235-5762

OBJECTIVE(S):
Samples of the absorbent and working models of highly innovative underwater retrieval mechanism have been extensively evaluated on pilot scale, in a test chamber simulating a contaminate driver site. The objective of this study is to confirm and qualify the performance of both the absorbent and the delivery system of choice under actual field conditions.

PROJECT DESCRIPTION:
This program involves: 1) The manufacturing of absorbent beads, building on the information gained to date on pilot scale production runs. 2) The manufacturing of casing mats. 3) The field testing of the absorbent and the delivery system. 4) The evaluation of the absorbents used in the field trials. 5) The development of novel crosslink polymers. 6) Full data analysis and compilation of the results.

BUDGET AND RESOURCES:

YEAR: (* current)	1	2	3*	TOTAL
COST: ($000.s)	97.3			97.3

BUDGET SOURCE: RAC, WRB, LSB TOTAL YEARS: 1

KEYWORDS:
absorbents, manufacturing,

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: 457G
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 08/89

PROJECT TITLE:
An Assessment of Land Use impact on the Microclimate of the Fonthill Kame

SHORT TITLE:
Microclimate Assessment of the Fonthill Kame

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr. Tony B. Shaw
Brock University

LIAISON OFFICER (name,branch,section,address,telephone no.):
Dr. D. Yap
Air Resources Branch
P.O. Box 213, 125 Resources Rd
Rexdale, Ontario M9W 5L1

(416) 235-5773

OBJECTIVE(S):
Two critical suggestions are suggested for assessing any likely modification to the Fonthill Kame's microclimate: any topographic changes, particularly slope changes, which will result in (a) a decrease of nocturnal minimum temperature by 1c below the threshold values as specified for tender fruit crops and (b) a reduction in wind seed below 1m'sec under radiation frost conditions (Shaw et al, 1988). Accordingly, the principal objective of this study is to provide a detailed assessment of the Kame's microclimate in terms of its spatial variations in temperature, noting in particular, evidence of the depth and rate of cold air drainage on a variety of slopes under radiation frost conditions. Apart from providing the necessary information on the microclimate variations on the Kame, which to date are poorly understood, this aspect of the study could identify specific areas of the kame where the application of numerical modelling studies will have a reasonable change of showing significant results.

PROJECT DESCRIPTION:
The Fonthill Kame, located in the town of Pelham, is the most important tender fruit area above the Niagara Escarpment. The combination of a favourable climate and well drained sandy loam soils permits the successful cultivation of tender fruits along with other fruit crops. The steep slopes of the Kame, projecting above the surrounding flat plain, facilitate the drainage of cold air under radiation frost conditions. The microclimate of the Fonthill Kame is to a large extent related to its topography. It is argued by some, that structural changes to the topography of the Kame will modify this microclimate. The chief concern is that cold air drainage, on which the production of tender fruits depends, could be altered significantly on those slopes which may support aggregate extraction. A modified climate could impact adversely on tender fruit crops on the Kame itself with possible consequences for areas contiguous to the kame. This study therefore, will attempt to assess the impact the impact of aggregate extraction use on the microclimate of the Fonthill Kame.

BUDGET AND RESOURCES:

YEAR: (* current)	1	2	3*	TOTAL
COST: ($000.s)	16.5	14.0		30.5

BUDGET SOURCE: RAC TOTAL YEARS: 2

KEYWORDS:
modelling, microclimates, Fonthill Kame, Land Use Impact

OUTPUT (papers, presentation, reports):
Interim report, June 1990; Interim Report December 1989

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:
In progress

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: 462G
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 10/89

PROJECT TITLE: The Relative Effect of Individual Environmental Factors on Indicator Bacterial Survival

SHORT TITLE: Environmental Factors/Indicator Bacterial Survival

PRINCIPAL INVESTIGATOR AND AFFILIATION:
E. Harris
Lake Simcoe Region Conservation Authority

LIAISON OFFICER (name,branch,section,address,telephone no.):
Mr. M. Young
Laboratory Services Branch
P.O. Box 213, 125 Resources Rd
Rexdale, Ontario M9W 5L1

(416) 235-5866

OBJECTIVE(S): To evaluate the effects of water quality variables on bacterial survival in a lab setting.

PROJECT DESCRIPTION: In vitro survival experiments will be conducted by suspending membrance diffusion chambers, containing cultures of fecal coliforms, E. coli and P. aeruginosa in aquaria. Concentrations of chemical parameters such as chloride dissolved phosphates, nitrates, nitrites, ammonium and dissolved organic carbon will be adjusted individually and their effect on bacterial die-off assessed. The effect of preditation and competition will be determined by adding non sterile water containing bacteria and plankton to chambers of the test bacteria. The effect of these biological factors on sediment bacterial survival will be determined by inoculating diffusion chambers, containing sterile and non sterile bed sediments, with the test bacteria. A total of 76 in vitro bacterial survival experiments will be performed.

BUDGET AND RESOURCES:

YEAR: (* current)	1	2	3	TOTAL
COST: ($000.s)	46.0			46.0

BUDGET SOURCE: RAC TOTAL YEARS: 1

KEYWORDS:
fecal indicator bacteria, survival, physical/chemical factors

OUTPUT (papers, presentation, reports):
Technology Transfer Conference, 1991

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:
Is now in draft form and has been combined with 344G

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: 465G
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 10/89

PROJECT TITLE:
CO2 Production and Carbon Cycling in Precambrian Shield Watersheds

SHORT TITLE:
CO2 Production/Carbon Cycling

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr. Sherry Schiff
University of Waterloo

LIAISON OFFICER (name,branch,section,address,telephone no.):
Dr. P.Dillon
Water Resources Branch
Bellwood Acres Road
Dorset, Ontario P0A 1E0

(705) 766-2418

OBJECTIVE(S):
To examine CO2 production in forested watersheds and quantify its importance to the production of acid neutralizing capacity. To examine CO2 fate in lakes by constructing mass balances for 2 lakes.

PROJECT DESCRIPTION:
Production of CO2 and carbon cycling in forested watersheds is important in the quantification of the natural and anthropogenic sources and sinks of carbon with regard to the global carbon budget and the generation of alkalinity to neutralize the effects of acidic precipitation. The proposed research involves a detailed investigation of CO2 production and transport in a small forested subcatchment and the construction of carbon and carbon isotope mass balances for two watersheds of contrasting physical characteristics near Haliburton, Ontario. Carbon isotopes 13C and 14C will be used extensively to gain information unavailable from standard chemical measurements on process involved in and rates of carbon cycling, residence times in the various carbon pools and the contributing sources of CO2 to the lake carbon budget.

BUDGET AND RESOURCES:

YEAR: (* current)	1	2*	3	TOTAL
COST: ($000.s)	33.6	32.6		66.2

BUDGET SOURCE: RAC TOTAL YEARS: 2

KEYWORDS:
carbon cycling, carbon isotopes, acidic precipitation

OUTPUT (papers, presentation, reports):

Refereed Journal Publications in Submittal;

Aravena, R.,S.L.Schiff, S.E. Trumbore and R. Elgood. 1991. Evaluating dissolved inorganic carbon cycling in a forested lake watershed using carbon isotopes. Radiocarbon (submitted Sept. 1991).

Trumbore, S.E., S.L. Schiff, R. Aravena and R. Elgood. 1991. Sources and transformation of dissolved organic carbon in a forested catchment: the role of soils. Radiocarbon (submitted Oct 1991).

Non-refereed Publications;

Aravena, R. and S.L. Schiff. 1991. Production and cycling of carbon in two watersheds on the Precambrian Shield. Ontario Ministry of the Environment: Technology Transfer Conference. November 1991.

Aravena, R. and S.L. Schiff. 1990. CO2 production and carbon cycling in Precambrian Shield Watersheds. Proceedings of Ontario Ministry of the Environment: Technology Transfer Conference. November 1990.

Abstracts of Presentations at National Mtgs;

Aravena, R. and S.L. Schiff. 1991. Evaluating dissolved inorganic carbon cycling in a forested lake watershed using carbon isotopes. 14th International Radiocarbon Conference. Tucson, Arizona. 20-24 May 1991.

Schiff, S.L., R. Aravena, S.E. Trumbore and P.J. Dillon. 1991. Production and cycling of carbon in forested watersheds. A 14C approach. 14th International Radiocarbon Conference, Tucson, Arizona. 20-24 May 1991.

Schiff, S.L., R. Aravena, and P.J. Dillon. 1990. Cycling the dissolved inorganic carbon in a softwater lake watershed, northern Ontario, Canada: a carbon isotope approach. Acidic deposition its nature and impacts, Royal Society of Edinburgh, Glasgow. 16-21 Sept. 1990.

Schiff, S.L., R. Aravena, S.E. Trumbore, P.J. Dillon and R. Elgood. 1991. Carbon cycling in forested watersheds: clues of confusion from carbon isotopes? Gordon Research Conference. July 1991.

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT: X	SOLICITED:	PROJECT NO: 466C
INTERNAL:	GRANT:	UNSOLICITED: X	START DATE: 10/89

PROJECT TITLE:
Determination of Hydrogeological and Contamination Transport Properties of Fractured, Weathered Leda Clay in Eastern Ontario

SHORT TITLE:
Hydrogeological and Contamination Transport Properties/Leda Clay

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Andre Y. D'Astous
Fondex Limited

LIAISON OFFICER (name,branch,section,address,telephone no.):
Mr. R.A. Dunn
Southeastern Region
Box 820, 133 Dalton Ave.
Kingston, Ontario K7L 4X6

(613) 521-3450

OBJECTIVE(S):
To assess the methods to determine the depth of hydraulically active, fractured Leda clay; to define maximum depths of fractures in clays of different thickness and deposition modes; to determine the contaminant transport properties of leda clay; to define the minimum thickness of clay necessary to protect the underlying aquifer.

PROJECT DESCRIPTION:
This research program will comprise field testing and modelling of groundwater transport phenomena. Monitoring and field experiments relating to groundwater flow, contaminant migration and physical properties of fractured clay will be conducted at four different sites in Eastern Ontario. Mathematical models will be employed to simulate field experiments. This research should lead to a better understanding of groundwater flow and contaminant migration in fractured leda clay, and to an evaluation of a new in-situ hydrogeologic testing techniques.

BUDGET AND RESOURCES:

YEAR: (* current)	1	2*	3	TOTAL
COST: ($000.s)	60.8	18.3		79.1

BUDGET SOURCE: RAC TOTAL YEARS: 2

KEYWORDS:
waste management, landfill, clay deposits

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:
project behind schedule

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: 467G
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 04/90

PROJECT TITLE: Practical Application of Fecal Coliform (FC) to Streptococcus Faecium Subsp. Casseliflavus SC and Bifidobacterium to SC Ratio to Determine Human and Animal Sources of Pollution

SHORT TITLE:
Human and Animal Sources of Pollution

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr. P.L. Seyfried
University of Toronto

LIAISON OFFICER (name,branch,section,address,telephone no.):
Mr. M. Young
Laboratory Services Branch
P.O. Box 213, 125 Resources Rd
Rexdale, Ontario M9W 5L1

(416) 235-5866

OBJECTIVE(S): Development of a simple and reliable field procedure for tracing and identifying human and/or animal fecal wastes inputs into natural water bodies or storm sewers. To develop a method of isolating and identifying S. faecium subsp. casseliflavis and test the applicability of new ratios in the field to distinguish human from animal sources of pollution. Examine fecal specimens to determine the levels and survival rates of this group of indicator organisms.

PROJECT DESCRIPTION: Previous studies on the characterization of fecal indicator organisms have indicated that SC may be an exclusive indicator of animal fecal pollution. Bifidocateria, on the other hand, are present in high levels in sanitary sewage and are recovered in high densities from human feces. To date no ratios using SC and bifidobacteria have been formulated or tested. It is the objective of this project to test the use of a novel group of indicator ratios in the field. Samples from street and farm runoff, storm sewers, and lakes and rivers impacted upon by sewage treatment plants will be collected and analyzed for bifidobacteria, FC, EC, and SC. Results of the field studies will confirm the applicability of these ratios for use in place of FC/FS to characterize human or animal sources of pollution. Additional studies on the most appropriate isolation media for SC as well as the source and the comparative survival of the aforementioned organisms in the environment will be conducted.

BUDGET AND RESOURCES:

YEAR: (* current)	1*	2	3	TOTAL
COST: ($000.s)	27.5			27.5

BUDGET SOURCE: RAC TOTAL YEARS: 1

KEYWORDS:
indicator bacteria, human/animal fecal inputs, FC, SC, EC, bifidobacteria

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:
RAC draft almost complete

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: 468G
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 04/90

PROJECT TITLE:
Zooplankton Communities and Water Chemistry of Sudbury Area Lakes: Changes Related to pH Recovery

SHORT TITLE:
Zooplankton Communities/Water Chemistry of Sudbury Lakes

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr. Gary Sprules
University of Toronto

LIAISON OFFICER (name,branch,section,address,telephone no.):
W. Keller
Northeastern Region
11th Floor, 199 Larch Street
Sudbury, Ontario P3E 5P9

(705) 675-4501

OBJECTIVE(S):
To investigate changes in zooplankton communities in Sudbury area lakes that have occurred since the 1970's and relate changes to altered water chemistry.

PROJECT DESCRIPTION:
Survey of zooplankton species composition and water chemistry in 92 Sudbury area lakes, for comparison with data collected in 1971-1973 by Sprules and Harvey. In these studies, pH was the major determined of zooplankton community structure in the Sudbury area, and acidified lakes contained a community typified by fewer species and a less complex structure than lakes contained a community typified by fewer species and a less complex structure than lakes of circumneutral pH. Recent literature suggests that Sudbury area lakes have become less acid in response to reductions in atmospheric acid loadings. Study will determine whether the observed recovery in pH is reflected in recovery of plankton communities in lakes, and if so, investigate rates of plankton recolonization and community change.

BUDGET AND RESOURCES:

YEAR: (* current)	1	2*	3	TOTAL
COST: ($000.s)	24.1			24.1

BUDGET SOURCE: RAC TOTAL YEARS: 1

KEYWORDS:
zooplankton, water chemistry, pH, Sudbury lakes

OUTPUT (papers, presentation, reports):
Presentations on preliminary results at:
1990 Technology Transfer Conference
1991 Canadian Society of Limnologists Meeting
1991 Sudbury Rehabilitation Workshop

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:
To date the results show that species richness has increased as pH has increased in many lakes. Additional data analyses are underway.

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: 469G
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 04/90

PROJECT TITLE:
Abiotic Factors Involved in Predicting Trace Metal Levels in Freshwater Bivalves

SHORT TITLE: Abiotic Factor/Freshwater Bivalves

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr. A. Tressier
University of Quebec

LIAISON OFFICER (name,branch,section,address,telephone no.):
P. Kauss
Water Resources Branch
4th Floor, 1 St. Clair Ave West
Toronto, Ontario M4V 1K6

(416) 323-4952

OBJECTIVE(S):
To describe biological significance of metals in sediments. To identify factors controlling metal accumulation by clams to enable prediction of these levels.

PROJECT DESCRIPTION:
Empirical approaches have proven disappointing predicting trace metal (M) concentrations in benthic organisms. A promising alternative is to identify the mechanisms underlying biological metal uptake and to use this knowledge to develop predictive models based on the geochemical and biological processes involved. Based on experimental observations, a mechanism is proposed that involves a control through adsorption reactions of the dissolved M concentrations in the solution to which the organisms are exposed. In situ measurements are proposed to verify this mechanism in the Dorset area with Elliptio complanta.

BUDGET AND RESOURCES:

YEAR: (* current)	1	2*	3	TOTAL
COST: ($000.s)	22.0			22.0

BUDGET SOURCE: RAC TOTAL YEARS: 1

KEYWORDS:
trace metal, freshwater bivalves

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT: X	SOLICITED:	PROJECT NO: 476C
INTERNAL:	GRANT:	UNSOLICITED: X	START DATE: 09/90

PROJECT TITLE:
Phytotoxicity of Uranium

SHORT TITLE:

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr. S.C. Sheppard
Whiteshell Nuclear Research Establishment

LIAISON OFFICER (name,branch,section,address,telephone no.):
J.J. Negusanti
Northeastern Region
11th Floor, 199 Larch Street
Sudbury, Ontario P3E 5P9

(705) 975-4501

OBJECTIVE(S):
To determine the concentration of U in soil that is toxic to plant growth, and to relate this toxicity to concentrations of U in plants and in soil extracts. To investigate how toxicity to U varies with differences in soil properties and among plant species. To document symptoms and associated consequences of high levels of U.

PROJECT DESCRIPTION:
Elevated levels of uranium (U) exist in Ontario soils, notably in Port Hope, associated with former radium processing, and near Elliot Lake, associated with former and current mining operations. Uranium in these settings does not represent a radiological hazard (although its radioactive progeny may). However, U is chemically toxic to plants, with some reports suggesting a level very close to normal background. This proposal is to establish toxicity levels for plants, using several soil types and plant species relevant to urban contamination scenarios. If toxicity is confirmed at levels found in Ontario soils, then the data will be important for setting cleanup criteria for remedial action.

BUDGET AND RESOURCES:

YEAR: (* current)	1	2*	3	TOTAL
COST: ($000.s)	29.7			29.7

BUDGET SOURCE: RAC, Low Level Radioactive
Waste Management Office TOTAL YEARS: 1

KEYWORDS:
uranium, phytotoxicity

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT: X	SOLICITED:	PROJECT NO: 479C
INTERNAL:	GRANT:	UNSOLICITED: X	START DATE: 06/90

PROJECT TITLE:
Dense Gas Dispersion Modelling Including Obstacles and Topography

SHORT TITLE:
Dense Gas Dispersion Modelling

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr. S.R. Ramsay
Envirotech Research Limited

LIAISON OFFICER (name,branch,section,address,telephone no.):
H. Sahota
Air Resources Branch
4th Floor, 880 Bay Street
Toronto, Ontario M5S 1Z8

(416) 235-5764

OBJECTIVE(S):
An extensive review of existing theoretical, experimental and field data relevant to telling the effects of topography and obstacles on dense gas dispersion. Development of analytical and numerical models to describe the effects of topography and obstacles. An extensive comparison study of model results with existing laboratory and field trial data, and the predictions of other models. The development of an operational modelling capability for emergency management including topography and obstacles.

PROJECT DESCRIPTION:
This proposal describes a study to develop dense gas dispersion modelling in the presence of buildings, obstacles and topography. The study will use the GASTAR model developed by Dr. R. Britter of Cambridge Environmental Research Consultants and Dr. S. Ramsay of EnviroTech Research Limited as the basis for further development. The current GASTAR model has limited capabilities in computing dense gas dispersion influenced by obstacles and topography however considerable additional work is required to develop a model suitable for operational emergency management. The work necessary to achieve this capability on an operational basis is described.

BUDGET AND RESOURCES:

YEAR: (* current)	1	2*	3	TOTAL
COST: ($000.s)	24.0	17.6		41.6

BUDGET SOURCE: RAC TOTAL YEARS: 2

KEYWORDS:
emergency response, gas dispersion, modelling

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: 480G
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 05/90

PROJECT TITLE:
Basic and Applied Studies with a Trace Gas Analyzer

SHORT TITLE:
Trace Gas Analyzer

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr. R.E. March
Trent University

LIAISON OFFICER (name,branch,section,address,telephone no.):
Mr. G. DeBrou
Air Resources Branch
4th Floor, 880 Bay Street
Toronto, Ontario M5S 1Z8

(416) 326-1660

OBJECTIVE(S): To carry out a program of research of ion-molecule reactions relevant to normal modes of operation of the TAGA.

PROJECT DESCRIPTION: A collaborative University-Ministry of the Environment, Ontario (MOE) study of the use of a Trace atmospheric Gas Analyzer (TAGA) over a period of three years is proposed. The TAGA is to be supplied by the MOE and installed at Trent University, Peterborough. Under the joint supervision of three university Investigators, affiliated with the Trent and York universities, research on gaseous ion/molecule reactions will be carried out and combined with optimizing analytical protocols for the detection and measurement of compounds of interested to the MOE. Emphasis will be given to the development of new techniques for chemical ionization of compounds deleterious to the environment, to the investigation of processes of ion fragmentation and ion cluster formation, and to the study of processes for the removal of specific compounds or classes of compounds.

BUDGET AND RESOURCES:

YEAR: (* current)	1	2*	3	TOTAL
COST: ($000.s)	52.6	49.6	50.9	153.1

BUDGET SOURCE: RAC, Lab Services Br. TOTAL YEARS: 3

KEYWORDS:
TAGA

OUTPUT (papers, presentation, reports):
Three progress reports

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X | CONTRACT: | SOLICITED: | PROJECT NO: 482G
INTERNAL: | GRANT: X | UNSOLICITED: X | START DATE: 05/90

PROJECT TITLE:
Analysis of Spatial and Temporal Distribution of Inhalable Air Particulates in Ontario

SHORT TITLE: Air Particulates/Spatial and Temporal Distribution Analysis

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr. R. Martin
University of Western Ontario

LIAISON OFFICER (name,branch,section,address,telephone no.):
Dr. J.C. Hipfner
Laboratory Services Branch
P.O. Box 213, 125 Resources Rd
Rexdale, Ontario M9W 5L1

(416) 235-5856

Peter Wong
Air Resources Branch

(416) 235-5765

OBJECTIVE(S):
To conduct a thorough study on PM10 in order to characterize the inhalable particulates (IP) less than 10 microns. To design an inhalable particulate database for the Ministry of the Environment and to analyze the data for use in the process of setting an inhalable particulate standard for Ontario.

PROJECT DESCRIPTION:
Inhalable air particulates, less than ten microns in average diameter, will be collected and studies to establish; (a) their bulk elemental composition, (b) the elemental distribution within individual particles, (c) the chemical state and reactivity of individual particles and aggregates of particles, (d) their size distribution and physical characteristics, (e) the spatial and temporal distribution of particles across the Province. A wide range of techniques will be used. Following collection of samples at approximately ten sites in Ontario using commercially available PM10 samples the material will be examined using X-ray fluorescence (XRF), Scanning Electron Microscopy (SEM), Secondary Ion Mass Sectrometry (SIMS), X-ray Photoelectron Spectroscopy (XPS) Electron Microprobe (EM), Scanning Auger Spectroscopy (SAM), Transmission Electron Microscopy (TEM) and various Synchrotron methods as well as optical methods including simple optical microscopy. The resulting data will be used to design an inhalable particulate standard for Ontario.

BUDGET AND RESOURCES:

YEAR: (* current)	1	2*	3	TOTAL
COST: ($000.s)	58.5	58.5		117.1

BUDGET SOURCE: RAC TOTAL YEARS: 2

KEYWORDS:
inhalable particulates, standards

OUTPUT (papers, presentation, reports):
Ist year report, July 1991

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:
Request has been made to spread the funding (no charge) over three years due to late starting of project.

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: 483G
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 04/90

PROJECT TITLE:
The Significance of Metabolic Changes in Jack Pine Seedlings for Early Diagnosis of Fluoride Injury

SHORT TITLE:
Jack Pine Seedlings/Fluoride Injury

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr. J.J. Zwiazek
University of Alberta

LIAISON OFFICER (name,branch,section,address,telephone no.):
D. McLaughlin
Air Resources Branch
4th Floor, 880 Bay Street
Toronto, Ontario M5S 1Z8

(416) 456-2504

OBJECTIVE(S):
Determine threshold fluoride levels which result in the accumulation of starch in the chloroplast and depletion of membrance lipids. Establish whether these metabolic symptoms of fluoride injury can be mimicked by water stress. Determine the suitability of both metabolic symptoms of fluoride injury in early detection of fluoride damage.

PROJECT DESCRIPTION:
The proposed study will investigate the effects of gaseous hydrogen fluoride on starch accumulation and the composition of membrane lipids in jack pine seedlings. It will determine the suitability of these metabolic parameters for early diagnostic detection of fluoride injury. The metabolic changes will be compared with those in water stressed plants to ensure that the effects of water stress and fluoride can be separated.

BUDGET AND RESOURCES:

YEAR: (* current)	1	2*	3	TOTAL
COST: ($000.s)	40.5	19.0		59.5

BUDGET SOURCE: RAC TOTAL YEARS: 2

KEYWORDS:
fluoride, Jack pine

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: 484G
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 05/90

PROJECT TITLE: Retention of Toxic Landfill Leachate Metals by Soil

SHORT TITLE:

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr. L.J. Evans
University of Guelph

LIAISON OFFICER (name,branch,section,address,telephone no.):
A. Oda
Waste Management Branch
Technology & Site Assessment
14th Floor, 2 St Clair Ave West
Toronto, Ontario M4V 1L5

(416) 323-5129

OBJECTIVE(S): To determine the amount of toxic metals, in particular Zn, Hg and Cd, retained by soils with widely differing characteristics so that predictions can be made on the amount of leachate metals retained by Ontario soils as a function of pH, clay and organic matter contents and mineralogy. Results from these studies, should help predict the extent of metal retention by soils associated with landfill sites and estimate the rate of movement of toxic metals to surface and groundwaters.

PROJECT DESCRIPTION: Laboratory studies involving the use of adsorption isotherms, potentiometric titrations and leaching columns will be used to determine the absorption capacity of the soils. Surface complexation models, such the Constant Capacitance Model, and transport flow equations will be used to calculate the rate of movement of the metals to surface and/or groundwater. The usefulness of these models will be tested in leached soils columns.

BUDGET AND RESOURCES:

YEAR: (* current)	1	2*	3	TOTAL
COST: ($000.s)	39.0	39.0		78.0

BUDGET SOURCE: RAC TOTAL YEARS: 2

KEYWORDS:
landfill, leachate, soil, heavy metals

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: 489G
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 04/90

PROJECT TITLE:
Development of Reliable Treatment Systems for Milkhouse Wash Water

SHORT TITLE:
Reliable Treatment System/Water

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr P.H. Groenevelt
University of Guelph

LIAISON OFFICER (name,branch,section,address,telephone no.):
K. Willson
Water Resources Branch
4th Floor, 1 St. Clair Ave West
Toronto, Ontario M4V 1K6

(416) 766-2418

OBJECTIVE(S):
Determine the principal causes for the failure of the present disposal system. Identify possible remedial modifications which can be made to the treatment trench system or the washing procedure which will insure trouble-free operation of this system in poorly drained soils for at least 25 years. Failing the second objective, develop disposal alternatives which are both environmentally sound and acceptable to Ontario farmers.

PROJECT DESCRIPTION: At present a large proportion of installed Treatment Trench systems for the disposal of milkhouse wash water have failed leaving farmers no alternative but to dump untreated wash water into ditches of field tiles. The estimated 180 tonnes of phosphorus per years being discharge from milkhouses in southern Ontario represents a serious environmental problem. The proposed research will focus on the fundamental reasons for practices as well as investigating possible disposal alternatives.

BUDGET AND RESOURCES:

YEAR: (* current)	1	2*	3	TOTAL
COST: ($000.s)	23.0	23.0		46.0

BUDGET SOURCE: RAC TOTAL YEARS: 2

KEYWORDS:
water

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT: X	SOLICITED:	PROJECT NO: 490C
INTERNAL:	GRANT:	UNSOLICITED: X	START DATE: 07/90

PROJECT TITLE:
Evaluation of the Impact of Timber Management Practices on Lake Water Using Satellite Remote Sensing Data

SHORT TITLE:
Remote Sensing/Timber Management

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr. H. George
Geoscan Ltd.

LIAISON OFFICER (name,branch,section,address,telephone no.):
B. Neary
Water Resources Branch
Bellwood Acres Road
Dorset, Ontario P0A 1E0

(705) 766-2418

OBJECTIVE(S):
To provide methodology for the routine operational surveillance of water quality impacts which are due to timber management practices and so alert the Water Resources Manager, in good time, of the need for detailed ground investigations.

PROJECT DESCRIPTION: Satellite remote sensing imagery of lakes will be digitally analyzed and used to map concentrations of inorganic suspended sediment which are related to logging activities within lake basins. The relationship between timber management practice and water quality will be evaluated.

BUDGET AND RESOURCES:

YEAR: (* current)	1	2*	3	TOTAL
COST: ($000.s)	32.9			32.9

BUDGET SOURCE: RAC TOTAL YEARS: 1

KEYWORDS:
remote sensing, water quality

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: 492G
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 04/90

PROJECT TITLE:
Causes of Pollution-Associated Neoplasms in Fish in Lake Ontario

SHORT TITLE:
Lake Ontario/Neoplasms

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr. M. Hayes
University of Guelph

LIAISON OFFICER (name,branch,section,address,telephone no.):
Ian R. Smith
Water Resources Branch
4th Floor, 1 St. Clair Ave West
Toronto, Ontario M4V 1K6

(416) 323-4920

OBJECTIVE(S):
Determination of the cause of intercurrent liver diseases that affects white suckers and brown bullheads in the Great Lakes. Develop of risk assessment criteria for environmental PAHs according to various disease, age or nutritional states that might render certain individual fish & humans more susceptible to PAHs.

PROJECT DESCRIPTION:
This project is aimed at determining the causative factors involved in pollution associated liver cancers in benthic fish (mainly white suckers), from industrially polluted sites in western Lake Ontario (Hamilton and Toronto). The study will establish the specific cause and role of the intercurrent hepatitis by determining how this disease interferes with gluthione S-transferase isoenzymes which are the most important detoxifying system for DNA-damaging metabolites of PAHs. These approaches toward the understanding of multifactorial carcinogenesis are essential to risk assessment of environmental PAHs because they will help to explain why these substances are sometimes carcinogenic but often are not. These studies will provide a mechanistic basis for deciding how health studies of wild fish can be reliably used to monitor the environmental improvements resulting from the MISA program.

BUDGET AND RESOURCES:

YEAR: (* current)	1	2*	3	TOTAL
COST: ($000.s)	54.2	56.6		110.8

BUDGET SOURCE: RAC TOTAL YEARS: 2

KEYWORDS:
pollution, neoplasms

OUTPUT (papers, presentation, reports):
G.W. Kirby, 1991 - PhD Thesis, University of Guelph

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: 496G
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 04/90

PROJECT TITLE: Characterization and Biotechnical Uses of the Extracellular Emulsifying Agent Produced by Pseudomonas aeruginosa

SHORT TITLE: Extracellular Emulsifying Agent

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr. H. Lee
University of Guelph

LIAISON OFFICER (name,branch,section,address,telephone no.):
Mr. M. Young
Laboratory Services Branch
P.O. Box 213, 125 Resources Rd
Rexdale, Ontario M9W 5L1

(416) 235-5866

OBJECTIVE(S):
To purify the extracellular oil emulsifier produced by Pseudomonas aeruginosa UG2. To identify the culture conditions necessary for optimal emulsifier production by UG2. To UG2 or the partially purified extracellular emulsifier from UG2 into hydrocarbon-contaminated soil in order to assess the influence of in situ emulsification on subsequent biodegradation of the hydrocarbon.

PROJECT DESCRIPTION:
Biological degradation in land farming sites is an attractive and ecologically acceptable means of disposing of wastes containing complex hydro-carbons. The proposed studies are intended to characterize bio-chemically a natural emulsifier produced by an environmental isolate of UG2. Positive research results arising from these studies may have considerable potential to enhance remediation in land farming or spill sites.

BUDGET AND RESOURCES:

YEAR: (* current)	1	2*	3	TOTAL
COST: ($000.s)	47.3	47.3	47.3	141.9

BUDGET SOURCE: RAC TOTAL YEARS: 3

KEYWORDS:
extracellular emulsifier, biological degradation, Pseudomonas aeruginosa

OUTPUT (papers, presentation, reports):
Jain, D.K., D.L. Collins-Thompson, H.Lee and J.T. Trevors. 1991. A Drop-Collapsing Test for Screening Surfactant-Producing Microorganisms. Journal of Microbiological Methods 13: 271-279.

Van Dyke, M.I., L. Hung, J.T. Trevors. 1991. Applications of Microbial Surfactants. Biotecn. Adv. V 9: 241-252

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: 502G
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 04/90

PROJECT TITLE:
Bioconversion of the Mechanically Separable Paper Fraction of Municipal Solid Waste to Fuel Alcohol

SHORT TITLE:
Bioconversion of Solid Waste to Fuel Alcohol

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr. M. Wayman
University of Toronto

LIAISON OFFICER (name,branch,section,address,telephone no.):
D.M. Ianescu
Waste Management Branch
14th Floor, 2 St. Clair Ave West
Toronto, Ontario M4V 1L5

(416) 323-5190

OBJECTIVE(S):
Determine the light fraction of MSW's potential for saccharification and for production of alcohol. Measure volume reduction, and make a mass balance of the process. Measure yields and enzyme requirements. Study processes for on-site manufacture of cellulase enzymes. Prepare a report which summarizes the results for this work, and considers the economic and technical factors in scale-up.

PROJECT DESCRIPTION:
This project is directed to reducing the volume of MSW now going to landfill, and the bioconversion of its paper content to a marketable product, the environmentally benign motor fuel alcohol (ethanol). The process begins with enzymatic saccharification of cellulose, the largest component of the paper, followed by fermentation to ethanol. The proposal also includes study of a process for in-plant low-cost enzyme production.

BUDGET AND RESOURCES:

YEAR: (* current)	1	2*	3	TOTAL
COST: ($000.s)	47.0	49.0		96.0

BUDGET SOURCE: RAC TOTAL YEARS: 2

KEYWORDS:
solid waste, fuel alcohol, bioconversion

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT: X	SOLICITED:	PROJECT NO: 503C
INTERNAL:	GRANT:	UNSOLICITED: X	START DATE: 09/90

PROJECT TITLE:
Development of an Enzyme Immunoassay for the Rapid Detection and Quantification of Glyphosate

SHORT TITLE:
Enzyme Immunoassay/Rapid Detection

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Mr. Claude J. Morin
Paracel Laboratories

LIAISON OFFICER (name,branch,section,address,telephone no.):
D. Hall
Laboratory Services Branch
P.O. Box 213, 125 Resources Rd
Rexdale, Ontario M9W 5L1

(416) 235-5910

OBJECTIVE(S):
Development of an enzyme immunoassay using polyclonal antibodies that could possibly, later be replaced by monoclonal antibodies.

PROJECT DESCRIPTION:
Amongst the pesticides used in the Province of Ontario, N-(Phosphonomethyl) glycine (glyphosate) is of major importance. The use of an enzyme immunoassay would be of great help in i) shortening the time required for the analysis of glyphosate and its major metabolite, aminoethylphophonic acid, ii) allowing the simultaneous analysis of many samples at the same time, and iii) lowering the detection limit.

BUDGET AND RESOURCES:

YEAR: (* current)	1	2*	3	TOTAL
COST: ($000.s)	74.8			74.8

BUDGET SOURCE: RAC TOTAL YEARS: 1

KEYWORDS:
enzyme immunoassay, glyphosate, rapid screening

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: 504G
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 04/90

PROJECT TITLE:
Development of Techniques and Methodologies for the Direct Analysis of Solids and Difficult Samples by ICE-AES and ICP-MS

SHORT TITLE:
ICE-AES/ICP-MS Analysis

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr. E. Salin
McGill University

LIAISON OFFICER (name,branch,section,address,telephone no.):
D. Boomer
Laboratory Services Branch
P.O. Box 213, 125 Resources Rd
Rexdale, Ontario M9W 5L1

(416) 235-5858

OBJECTIVE(S):
Development of instrumentation and methodologies which provide significant improvement in elemental analysis capabilities. The proposal is concentrating in two areas ((1) reduction of sample preparation by eliminating or reducing the requirement and (2) improvement in detection limits. The approach is targeted at ICP based instrumentation (of which the MOE has 10, because they should offer good detection limits and high throughput when the work is completed.

PROJECT DESCRIPTION:
Based on the University's experience (project 270), they propose the extension of their work with Direct Sample Insertion (DSI) for both ICP-AES and ICP-MS. Now the university proposes the development of methodologies for specific MOE sample types which are suitable for DSI-ICP sample introduction.

BUDGET AND RESOURCES:

YEAR: (* current)	1	2*	3	TOTAL
COST: ($000.s)	37.0	39.0	41.0	117.0

BUDGET SOURCE: RAC TOTAL YEARS: 3

KEYWORDS:
ICP-AES, ICP-MS, solids analysis, direct analysis, trace metals

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: 505G
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 04/90

PROJECT TITLE:
Physical Modelling of Contaminant Plumes from Landfills

SHORT TITLE:
Contaminant Plumes Modelling

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr. R.J. Mitchell
Queens University

LIAISON OFFICER (name,branch,section,address,telephone no.):
Dr. C.A. Bostock
Waste Management Branch
14th Floor, 2 St. Clair Ave West
Toronto, Ontario M4V 1L5

(416) 323-5218

OBJECTIVE(S):
To apply expertise in physical modelling of geotechnical phenomenon to the problems of contaminant transport in partly saturated soils. To produce realistic and accurate data on contaminant migration from landfills, tank leakages or spills and to develop correlations between the physical model results and numerical techniques for predicting plume development.

PROJECT DESCRIPTION: Problems of groundwater flow and contaminant transport in partly saturated soils cannot be solved using numerical techniques. Physical modelling by means of a geotechnical centrifuge offers an attractive alternative. Municipal landfills are generally sited on partly saturated soils and the prediction of potential contaminant plume development should some liner leakage occur is a problem which can be accurately modelled in Queen's geotechnical contrifuge.

BUDGET AND RESOURCES:

YEAR: (* current)	1	2*	3	TOTAL
COST: ($000.s)	18.5	16.5	15.5	50.5

BUDGET SOURCE: RAC TOTAL YEARS: 3

KEYWORDS:
modelling, contaminant plumes, landfills

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X | CONTRACT: X | SOLICITED: | PROJECT NO: 509C
INTERNAL: | GRANT: | UNSOLICITED: X | START DATE: 04/90

PROJECT TITLE:
Economy-Environment Linkages and Sustainable Development in Ontario

SHORT TITLE:
Sustainable Development/Ontario

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr.P.A. Victor
VHB Research and Consulting Inc.

LIAISON OFFICER (name,branch,section,address,telephone no.):
J.A. Donnon
Policy and Planning
135 St. Clair Ave. West
11th Floor
Toronto, Ontario M4V 1P5

(416) 323-4579

OBJECTIVE(S):
To develop a framework that will: provide a means of quantifying economy - environment linkages in Ontario; assist the examination of sustainable of development in Ontario through scenario analysis. A secondary objective is to generate a basis for integrated provincial economy-environment accounts. To lay the groundwork for the extension of the framework to include a model of one or more renewable resources in Ontario.

PROJECT DESCRIPTION:
The main tasks to be performed are: to assemble data bases on resources used and wastes by economic sector and on the population and resources at risk, to add production technologies to a regionalized input-output model, to incorporate the environmental protection sector in the input-output model as well as the data on resources and wastes, to develop scenarios and undertake scenario analysis, and to prepare a report and user manual.

BUDGET AND RESOURCES:

YEAR: (* current)	1	2*	3	TOTAL
COST: ($000.s)	135.6	61.2		196.8

BUDGET SOURCE: RAC TOTAL YEARS: 2

KEYWORDS:
sustainable development, economy, environment

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: 510G
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 04/90

PROJECT TITLE:
Determination of Geochemical Modification of Groundwater Entering Surface Waters from an Industrial and Municipal Disposal Site

SHORT TITLE:
Groundwater into Surface Waters from Disposal Sites

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr. D.R. Lee
University of Waterloo

LIAISON OFFICER (name,branch,section,address,telephone no.):
R. Dryan
River's Project

(519) 336-4030

OBJECTIVE(S):
To determine the contaminant flux from two known discharge areas, one adjacent to the Algoma Steel Plant in the St. Marys River and one down gradient from either the North Bay or the Deep River municipal landfills. The long-term objective is to provide a scientific basis for regulation of groundwater-contaminant loading of surface water.

PROJECT DESCRIPTION:
Continued efforts to reduce surface-water pollution require assessment of groundwater and contaminant flux. It is now possible to locate zones of contaminant flux and measure the water flux and chemical gradient in the shallow sediments of discharge zones. This topic is pertinent because without consideration of this geochemical interface, it will not be possible predict solute fluxes from zones of groundwater contamination to surface water.

BUDGET AND RESOURCES:

YEAR: (* current)	1	2*	3	TOTAL
COST: ($000.s)	19.5	16.7		36.2

BUDGET SOURCE: RAC TOTAL YEARS: 2

KEYWORDS:
groundwater, disposal site, surface water

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT: X	SOLICITED:	PROJECT NO: 511C
INTERNAL:	GRANT:	UNSOLICITED: X	START DATE: 04/90

PROJECT TITLE:
Development and Validation of a New, Rapid, and Economical Surrogate Bioassay for Industrial Contaminants

SHORT TITLE:
Surrogate Bioassay for Industrial Contaminants

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Mr. Guy L. Gilron
Borealis Environmental Consulting

LIAISON OFFICER (name,branch,section,address,telephone no.):
D. Poirer
Water Resources Branch
P.O. Box 213, 125 Resources Rd
Rexdale, Ontario M9W 5L1

(416) 235-5795

OBJECTIVE(S):
To establish toxicological dose-response relationships using a novel 15-min chemotactic bioassay technique for the ciliated protist, Tetrahymena vorax, using industrial waste discharges and evaluate the predictive capability of this test by comparing it to standard bioassays using Daphnia magna and rainbow trout. The proposed study would address the need for a more inexpensive, simple, and rapid test for toxicant mixtures.

PROJECT DESCRIPTION:
In light of the need for the development of predictive dose-response relationships for aquatic organisms, tests focusing on other trophic levels, for which tests are rapid and economical, merit further investigation. Although microbial communities have been used in the assessment of pollutant effects, their importance and usefulness as indicators have been generally been overlooked. We propose to develop a toxicological dose-response relationship for Tetrahymena vorax.

BUDGET AND RESOURCES:

YEAR: (* current)	1*	2	3	TOTAL
COST: ($000.s)	47.9			47.9

BUDGET SOURCE: RAC TOTAL YEARS: 1

KEYWORDS:
bioassay, contaminants

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: 513G
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 04/90

PROJECT TITLE:
Novel Approach for the Development of Transgenic Plants Resistant to Pathogens: An Alternative to Reduce the Use of Chemical Pesticides

SHORT TITLE:
Transgenic Plants Resistant to Pathogens

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr. M.G. AbouHaidar
University of Toronto

LIAISON OFFICER (name,branch,section,address,telephone no.):
J. S. Bailey
Hazardous Contaminants Branch
12th Floor, 2 St. Clair Ave West
Toronto, Ontario M4V 1L5

(416) 323-5005

OBJECTIVE(S):
To develop "transgenic" plants (tomato, potato, peas and impatiens) resistant to certain economically important viruses {tomato spotted wilt virus (TSWV), potato virus X (PVX), potato virus Y (PVY), clover yellow mosaic virus (CYMV) and other viruses}. Another objective of this study is to make this novel approach, a model study for the development of other plants resistant not only to viruses but also to other pathogens and pests.

PROJECT DESCRIPTION:
The aim of this study is to use the novel "Ribozyme" as a tool to specifically cut the viral genome and confer resistance to virus infection. Other well established molecular techniques of gene transfer, plant transformation and regeneration will be used to develop "transgenic tomato, potato and impatiens cultivars resistant to certain economically important viruses. As a result the need for chemical pesticides to control insects vectors (i.e. aphids, white flies, thrips etc.) will be drastically diminished.

BUDGET AND RESOURCES:

YEAR: (* current)	1	2*	3	TOTAL
COST: ($000.s)	32.2	32.2	32.2	96.6

BUDGET SOURCE: RAC, OMAF TOTAL YEARS: 3

KEYWORDS:
transgenic plant, viruses, ribozyme

OUTPUT (papers, presentation, reports):
None to date

EXTERNAL PARTICIPATION (ministries, governments, agencies):
OMAF

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: 514G
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 09/90

PROJECT TITLE:
Development of Procedures for Improved Data Quality for Monitoring Sewage Plants Under the MISA Program

SHORT TITLE:
MISA/Sewage Plant Monitoring

PRINCIPAL INVESTIGATOR AND AFFILIATION:
P. Sly
Canadian Association of Environmental Analytical Laboratories (CAEAL)

LIAISON OFFICER (name,branch,section,address,telephone no.):
S. Villard
Laboratory Services Branch
P.O. Box 213, 125 Resources Rd
Rexdale, Ontario M9W 5L1

(416) 235-5748

OBJECTIVE(S):
To establish a laboratory certification/accreditation process. The process and associated criteria will be used to establish the performance level of Ontario analytical laboratories. This work will facilitate the privatization program of the Ontario Government. This work will also enhance the performance and quality of private-sector laboratories, and improve their competitiveness in both the Canadian and U.S.A. markets.

PROJECT DESCRIPTION:
To determine the capabilities and performance of Ontario-based laboratories that support MISA program monitoring activities for sewage treatment plants. To develop laboratory Code-of-Practice documents. To develop generalized accreditation/certification schemes and associated criteria. To establish formal mechanisms for technology transfer of new analytical and quality assurance methods to Ontario environmental laboratories.

BUDGET AND RESOURCES:

YEAR: (* current)	1	2*	3	TOTAL
COST: ($000.s)	151.0	62.0		213.0

BUDGET SOURCE: RAC TOTAL YEARS: 2

KEYWORDS:
MISA, sewage treatment plants, QA/QC, round-robin

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: 515G
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 08/90

PROJECT TITLE:
Methods of Revegetating the Kam-Kotia Tailings Site

SHORT TITLE:
Revegetating the Kam-Kotia Tailings Site

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr. Keith Winterhalder
Laurentian University

LIAISON OFFICER (name,branch,section,address,telephone no.):
Mr. Ken Gibson
Northeastern Region
11th Floor, 199 Larch Street
Sudbury, Ontario P3E 5P9

(705) 268-3222

OBJECTIVE(S):
To carry out a number of small scale trials of varied revegetation techniques at the Kam-Kotia mine/mill complex, which has been closed since 1972. The tests are to look for opportunity/alternatives and possible methods in revegetating a portion and/or portions of the area.

PROJECT DESCRIPTION:
Acid mine tailings are a large problem in Northern Ontario and in other jurisdictions in Canada and the United States. There is a real need for research into appropriate close-out technology to prevent the Crown from having to invent large sums for perpetual care modes. A suitable close-out strategy is a high priority at the Kam-Kotia site. The research study will identify the area of research, establish a strategy for revegetation treatment, select the plot areas, identify growth medium and plant metal tolerant plants, carry out chemical analysis of soil types, and monitor/document survival of test plant success within test plots.

BUDGET AND RESOURCES:

YEAR: (* current)	1*	2	3	TOTAL
COST: ($000.s)	12.0			12.0

BUDGET SOURCE: RAC, MNDM, MNR TOTAL YEARS: 2

KEYWORDS:
revegetation, Kam-Kotia

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: 516G
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 12/90

PROJECT TITLE:
Solid Waste Management Land Based Rainbow Trout Culture

SHORT TITLE:
Pollution from Aquaculture

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr. Peter S. Chisholm
University of Guelph

LIAISON OFFICER (name,branch,section,address,telephone no.):
Mr. Steve Klose
Water Resources Branch
4th Floor, 1 St. Clair Ave West
Toronto, Ontario M4V 1K6

(416) 323-4817

OBJECTIVE(S):
Monitor and model non-filterable solid wastes produced during the operation of land based rainbow trout culture systems. Determine design requirements for the settling and thickening of solid wastes and the control of total phosphorus in effluent from fish holding systems. Evaluate the feasibility of achieving current effluent quality standards of suspended solids and phosphorus for normal operation and for cleaning operations. Provide guidelines for the design of solid waste management works in new fish culture systems and in retro-fit of existing systems.

PROJECT DESCRIPTION:
Determine from the effluent of fish holding system;
a) the depth, surface area, and retention time requirements for controlled clarification of flocculant suspensions (less than 20 ppm) of non-filterable solids. b) the depth, surface area, and retention time requirements for controlled thickening of solids deposits from flocculant suspensions (less than 20 ppm), c) the release of soluble phosphorus, during the controlled thickening of settled solids, to effluent from the controlled settling zone, d) the designs appropriate for different cases.

BUDGET AND RESOURCES:

YEAR: (* current)	1	2*	3	TOTAL
COST: ($000.s)	14.8	14.0		28.8

BUDGET SOURCE: RAC TOTAL YEARS: 2

KEYWORDS:
rainbow trout, flocculant suspensions, culture systems

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: 517G
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 12/90

PROJECT TITLE:
Solid Waste Stabilization in a Landfill Environment

SHORT TITLE:
Waste Stabilization in Landfill

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr W. Kirk
University of Toronto

LIAISON OFFICER (name,branch,section,address,telephone no.):
Mr Mel Fielding
Waste Management Branch
14th Floor, 2 St. Clair Ave West
Toronto, Ontario M4V 1L5

(416) 323-4817

OBJECTIVE(S):
1. maintain 12 of the 16 simulated landfill test cells through the stabilization phase to determine the significance of heavy metals leaching with loss of biological activity, 2. Perform a detailed analysis on 3 selected test cells to determine the physical, chemical and morphological transformations of the solid wastes caused by the landfill environment, 3) Perform a depth profile analysis of the selected test cells to determine the extent of migration of the leachable heavy metals from the solid wastes.

PROJECT DESCRIPTION:
The pH, eH and interstitial moisture depth profile analysis will be conducted. These selected tests cells will be moved from the original site to a clod room to be frozen for subsequent morphological studies. Sampling protocols will be refined to provide the required sample size and depth requirement for surface analysis and compound identification. In year two, the work will probe the middle and bottom layers of the stabilizing municipal refuse.

BUDGET AND RESOURCES:

YEAR: (* current)	1	2*	3	TOTAL
COST: ($000.s)	38.0	40.0		78.0

BUDGET SOURCE: RAC TOTAL YEARS: 2

KEYWORDS:
solid waste, landfill, test cells

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: 518G
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 01/90

PROJECT TITLE:
Development of a Video Image Based Maple Decline Index

SHORT TITLE:
Video Maple Decline Index

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr. Doug King
Ryerson

LIAISON OFFICER (name,branch,section,address,telephone no.):
Mr. Dave McLaughlin
Air Resources Branch
4th Floor, 880 Bay Street
Toronto, Ontario M5S 1Z8

(416) 456-2504

OBJECTIVE(S):
1. Monitor and evaluate decline progress of selected maple trees in terms of spectral and textural image characteristics. 2. Determine optimum time of the growing and season and optimum spectral bands for multispectral aerial video imaging for maple decline assessment. 3. Determine relative accuracy and operational cost-effectiveness of the aerial video decline index through comparison with the ground-based index on an individual tree basis.

PROJECT DESCRIPTION:
Preparation and periodic acquisition of multispectural aerial video over selected MOE test sites in conjunction with ground-based data acquisition related to maple decline. Data analysis to determine optimum time of imaging and optimum spectral bands. Statistical comparison of video-based index models divided in previous studies with ground-based information to determine best video index model. Determination of operational cost effectiveness of each method.

BUDGET AND RESOURCES:

YEAR: (* current)	1	2*	3	TOTAL
COST: ($000.s)	25.0			25.0

BUDGET SOURCE: RAC TOTAL YEARS: 2

KEYWORDS:
video image, maple tree, decline

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: 519G
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 12/90

PROJECT TITLE:
To Develop a Reliable Economical and Environmentally Safe Method of Milkhouse Effluent Disposal Using Pretreatment and/or Modified Leaching

SHORT TITLE:
Milkhouse Effluent Treatment

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Mr. Claude Weil
Alfred College

LIAISON OFFICER (name,branch,section,address,telephone no.):
Mr. Murray Blackie
Southwestern Region
985 Adelaide Street South
London, Ontario N6E 1V3

(519) 661-1710

OBJECTIVE(S):
To develop guidelines for an economical, reliable and environmentally safe system of milkhouse effluent disposal for Ontario farmers. Leaching beds system and Sequential Batch Reactors will be compared and evaluated through on-farm, laboratory and controlled research site testing and monitoring. The possibility of specific designs for different soil types and different limiting conditions will be explored.

PROJECT DESCRIPTION:
Literature reviews, Lab tests to determine milkhouse effluent properties, Filter bed study, soil study, Establishment of Controlled Research Site at ACAFT, Establishment of one farm demonstration site, Monitoring of Controlled Research Site at ACAFT, Evaluate pretreatment methods at research site, Monitor on-farm demonstration sites, Complete monitoring of Controlled Research Sites, Periodic monitoring of on-farm demonstration sites.

BUDGET AND RESOURCES:

YEAR: (* current)	1	2*	3	TOTAL
COST: ($000.s)	58.3	32.1	30.6	121.0

BUDGET SOURCE: RAC TOTAL YEARS: 3

KEYWORDS:
controlled research site, milkhouse effluent,

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: 520G
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 11/90

PROJECT TITLE:
Intervention of Polycyclic Aromatic Hydrocarbons with Higher Plants: Bioconcentration, Phototoxicity, and Development of Phototoxicity Assay.

SHORT TITLE:
Photoinduced Toxicity of Polycyclic Aromatic Hydrocarbons to the Higher Plants Lemna gibba L.G-3.

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr. B.M. Greenberg
University of Waterloo

LIAISON OFFICER (name,branch,section,address,telephone no.):
Mr. Bryan Leece
Hazardous Contaminants Branch
12th Floor, 2 St. Clair Ave West
Toronto, Ontario M4V 1L5

(416) 323-5113

OBJECTIVE(S):
To address the interaction of PAH with plants at two levels;
- to evaluate the extent and kinetics of PAH assimilation by plants, and to investigate photoinduced toxicity of PAH to plants.
- to develop the technology required to use Lemna as a model system for studying phototoxicity.

PROJECT DESCRIPTION:
The bioconcentration of six representative PAH in plants be quantified and the photoinduced toxicity of these plants will be evaluated.

BUDGET AND RESOURCES:

YEAR: (* current)	1*	2	3	TOTAL
COST: ($000.s)	38.3			38.3

BUDGET SOURCE: RAC TOTAL YEARS: 1

KEYWORDS:
bioconcentration, phototoxicity, PAH, Lemna, duck weed, ozone depletion, photoinduced toxicity

OUTPUT (papers, presentation, reports):
Internal progress report to MOE

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:
The work is reaching completion and a final report will be forth coming.

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X | CONTRACT: | SOLICITED: | PROJECT NO: 521G
INTERNAL: | GRANT: X | UNSOLICITED: X | START DATE: 11/90

PROJECT TITLE:
Development of Hepatic Micronucleus Assay in Fish

SHORT TITLE:
Fish Micronucleus Assay

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr. C.D. Metcalfe
Trent University

LIAISON OFFICER (name,branch,section,address,telephone no.):
Dr. I Smith
Water Resource Branch
4th Floor, 1 St. Clair Ave West
Toronto, Ontario M4V 1K6

(416) 323-4920

OBJECTIVE(S):
Develop an in-vivo assay for clastogenic chemicals using rainbow trout. This assay will be applied to wild fish to investigate the levels of environmental clastogens.

PROJECT DESCRIPTION:
In year one, rainbow trout will be treated with model clastogenic agents and nitrogenic insults to develop a model system for the induction of hepatic micronucleus.
In year two, the model system will be adapted to wild fish captured from an area suspected of containing clastogenic chemicals.

BUDGET AND RESOURCES:

YEAR: (* current)	1	2*	3	TOTAL
COST: ($000.s)	15.0	15.0		30.0

BUDGET SOURCE: RAC TOTAL YEARS: 2

KEYWORDS:
trout, liver, micronucleus, clastogenic

OUTPUT (papers, presentation, reports):
1991 Technology Transfer Conference - poster

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: 522G
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 01/91

PROJECT TITLE:
Validation of Pulmonary Mutagenicity as an Order of Pulmonary Carcinogenicity.

SHORT TITLE:
Pulmonary Mutagenicity

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr. J. A. Heddle
York University

LIAISON OFFICER (name,branch,section,address,telephone no.):
Dr. P. Muller
Hazardous Contaminants Branch
12th Floor, 2 St. Clair Ave West
Toronto, Ontario M4V 1L5

(416) 323-5109

OBJECTIVE(S):
- to establish the genetic nature of the events in gene mutation and chromosomal abbreviations
- investigate the influence of important variables in the assays
- extend the validation of the assays to new chemicals
- investigate the quantitative correlation between mutagenic and carcinogenic effects of exposure

PROJECT DESCRIPTION:
The research will begin with the measurement of DNA content in micronuclei and establishment of 20 TGr clones. The determination of age response in chinese hamsters, of the species specifically of 3 agents, as well as that of the stability of resistance to TG will follow. Carcinogenic and non-carcinogenic PAHs will also be tested. The testing of three complex mixtures and measurement of vivo repair or selection is conducted prior to the testing for altered hpt genes in the TGr clones, the non-pulmonary carcinogens, and the most relevant compounds for extension of the qualitative correlation with carcinogenicity. Preliminary trails with putative promoters, and gaseous pollutants as possible promoters is a final component of the research.

BUDGET AND RESOURCES:

YEAR: (* current)	1*	2	3	TOTAL
COST: ($000.s)	65.8	65.8	65.8	197.4

BUDGET SOURCE: RAC TOTAL YEARS: 6

KEYWORDS:
mutagenicity, carcinogenicity, pulmonary

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: 524G
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 05/91

PROJECT TITLE:
Share Maple Decline and Correspondence Chemical Changes in Major Polymers in the Stem Tissue (Carbohydrates, Lignins, and Trace Elements)

SHORT TITLE:
Trace Elements and polymers in Declining Tree Wood

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Prof. D.N. Roy
University of Toronto

LIAISON OFFICER (name,branch,section,address,telephone no.):
J. Craig Kinch
Air Resources Branch
Suite 347, 880 Bay Street
Toronto, Ontario M5S 1Z8

(416) 456-2504

OBJECTIVE(S):
1. To investigate organic and trace elemental composition of stem tissue from healthy trees to establish the base-line information.
2. To compare the results with the stem tissues for low, medium, and highly declined trees.
3. To establish the chemical index (CI) of maple decline in selected sites of Ontario.
4. To compare the chemical index (CI) with the external indexing system (DI) of MOE and used by MOE and IES groups.
5. To compare the chemical data of sap with the stem tissue data in so far as carbohydrates and macro- and micro-nutrients are concerned.
6. To relate CI to known indices of climatic, site, atmospheric and biological variables (which are either already observed or are in the process of being consolidation) in a cause-effect manner.

PROJECT DESCRIPTION:
This research study addresses the possible relationship of sugar maple decline and consequent chemical changes in sap and wood composition, which might correlate with the degree of decline. Ten maple trees (5 healthy and 5 declining) are selected from 10 sites across NE-SW gradient of Ontario. Increment borings will be collected for these trees during late spring. Detailed analysis of carbohydrates, trace elements and lignins will be performed using High Pressure chromatographic and instrumental Neutron Activation techniques, respectively. After establishing the baseline of chemical composition of wood from healthy trees, a system of chemical indexing line of decline will be devised as s possible "early warning syndrome" of maple decline. Decline indexing will be compared with the results of our work on sap chemistry.

BUDGET AND RESOURCES:

YEAR: (* current)	1*	2	3	TOTAL
COST: ($000.s)	30.8	31.5	26.7	89.0

BUDGET SOURCE: RAC TOTAL YEARS: 3

KEYWORDS:
forest decline, sugar maple, carbohydrates, lignins trace elements, dendrochemistry

OUTPUT (papers, presentation, reports):
In progress

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT: X	SOLICITED:	PROJECT NO: 525C
INTERNAL:	GRANT:	UNSOLICITED: X	START DATE: 08/91

PROJECT TITLE:
Development of Bioassay Protocols for Toxicants in Soil

SHORT TITLE:
Bioassay Protocols in Soils

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr. Steve Sheppard
AECL Research

LIAISON OFFICER (name,branch,section,address,telephone no.):
Marius Marsh
Air Resources Branch
4th Floor, 880 Bay Street
Toronto, Ontario M5S 1Z8

(416) 456-2505

OBJECTIVE(S):
1. To survey the literature and contacts in Canadian and US regulatory agencies to review and summarize existing protocols.
2. To establish operating parameters for test protocols for plants, invertebrates and microbes, most likely involving short-life-cycle plants, earthworms and soil enzyme analyses.
3. To evaluate the sensitivity of the tests to a discrete set of toxicants, likely including aged oil residues and selected heavy metals and organic pesticides.

PROJECT DESCRIPTION:
Document test protocols currently in use throughout the world. Review and evaluate these protocols for use in MOE applications and decide on best protocols for further development. Determination of a well specified set of operating procedures under which the test must be conducted. Evaluation of these using a series of toxicants. Further testing using contaminants of concern to the MOE will provide both additional evaluation of protocols and information on important contaminants.

BUDGET AND RESOURCES:

YEAR: (* current)	1*	2	3	TOTAL
COST: ($000.s)	50.8	42.8		93.6

BUDGET SOURCE: RAC TOTAL YEARS: 2

KEYWORDS:
bioassay, toxicity, plants, invertebrates, soil, earthworms, brassica, phytotoxicity contaminants, heavy metals

OUTPUT (papers, presentation, reports):
Progress Report, Sept 6, 1991

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:
Final Report Sept 1992

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT: X	SOLICITED:	PROJECT NO: 526C
INTERNAL:	GRANT:	UNSOLICITED: X	START DATE: 05/91

PROJECT TITLE:
Review and Development of Methods for Measuring Mercury in Precipitation

SHORT TITLE:
Mercury Monitoring Methods

PRINCIPAL INVESTIGATOR AND AFFILIATION:
N.D. Johnson
Ortech International

LIAISON OFFICER (name,branch,section,address,telephone no.):
Dr. N.W. Reid
Air Resources Branch
4th Floor, 880 Bay Street
Toronto, Ontario M5S 1Z8

(416) 326-1691

OBJECTIVE(S):
To provide, if possible, a method for the routine network monitoring of mercury in precipitation.

PROJECT DESCRIPTION:
Following a preliminary literature review, a prototype sampler will be constructed and evaluated.

BUDGET AND RESOURCES:

YEAR: (* current)	1*	2	3	TOTAL
COST: ($000.s)	24.8	58.1	31.6	114.5

BUDGET SOURCE: RAC TOTAL YEARS: 3

KEYWORDS:
mercury, precipitation, toxic, deposition

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):
Ontario Hydro

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: 527G
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 06/91

PROJECT TITLE:
Health Effects of Air Pollution Assessed Using Ontario Health Survey Data

SHORT TITLE:
Air Pollution and Ontario Health Survey

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr. L.D. Pengelly
McMaster University

LIAISON OFFICER (name,branch,section,address,telephone no.):
Mr. Don Ogner
Air Resources Branch
4th Floor, 880 Bay Street
Toronto, Ontario M5S 1Z8

(416) 326-1663

OBJECTIVE(S):
To determine if a portion of the variability of health in the Province can be attributed to differences in air quality, using Ontario Health Survey (OHS) data, Ontario Ministry of the Environment (OME) Air Quality Index (AQI) data, and controlling for confounding variables.

PROJECT DESCRIPTION:
Data from the OHS will be obtained from the Ontario Ministry of Health in the form of a large file containing approximately 45000 observations of over 100 variables. Air pollution data from OME Air Quality Index (AQI) sites (over 30) from June 1989 to November 1990 will be obtained for all of the constituent measures of the AQI, as well as sulphates, where available. The two data sets will be combined, and analysis carried out using computer resources at McMaster University, as well as those of the MEP Company. Analysis of variance and stepwise linear regression analyses will be used to determine the relative strength of air pollution variables in accounting for the variability of health measures among Public Health Units.

BUDGET AND RESOURCES:

YEAR: (* current)	1*	2	3	TOTAL
COST: ($000.s)	45.0			45.0

BUDGET SOURCE: RAC TOTAL YEARS: 1

KEYWORDS:
Health Surveys, Ontario, air pollution

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT: X	SOLICITED:	PROJECT NO: 528C
INTERNAL:	GRANT:	UNSOLICITED: X	START DATE: 09/91

PROJECT TITLE:
Dense Gas Dispersion Modelling Including Buildings and Obstacles

SHORT TITLE:
Dense Gas Dispersion Modelling

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr. Stephen Ramsay
Envirotech Research ltd.

LIAISON OFFICER (name,branch,section,address,telephone no.):
Mr. H. Sahota
Air Resources Branch
P.O. Box 213, 125 Resources Rd
Rexdale, Ontario M9W 5L1

(416) 235-5764

OBJECTIVE(S):
The objectives of this study are:
1. To use the large base of existing knowledge of toxic gas dilution processes to produce practical prediction methods for predicting exposure levels;
2. To fill in gaps in the existing information for complex release conditions and the influence of nearby obstacles and buildings, to make methods developed applicable to a wide range of real situations;
3. To test the accuracy of the final methods, and to assess their limitations and maximize their accuracy; and,
4. To develop planning models which can be used to set safe exclusion and evacuation zones to limit the risk of toxic gas exposure in residential and work areas near industrial plant sites.

PROJECT DESCRIPTION:
Extensive review and compilation of laboratory and field data relating to the effect of obstacles on dense gas dispersion will be undertaken. Also, further development of analytical and numerical models of the influence of obstacles on dense gas dispersion. This modelling will attempt to provide, for each case, a model of the influence on dense gas dispersion and an indication of the conditions under which the model can be applied. The limitations in applying the model will be identified where possible. The FEM3 finite element model will be used to simulate the dense gas dispersion around obstacles as a basis for comparison with the simpler box model approach and as a basis for development of appropriate parameterizatións of the interactions. The shallow water equations described will be used to develop analytical and numerical models for comparison with simpler box results and as a basis for model development. The final phase of the study will emphasize the implementation of a dense gas dispersion model in an operational setting for emergency management applications. The requirements for an operational model will be investigated including the data requirements for emergency response and the operational procedure to be used.

BUDGET AND RESOURCES:

YEAR: (* current)	1*	2	3	TOTAL
COST: ($000.s)	33.9			33.9

BUDGET SOURCE: RAC TOTAL YEARS: 1

KEYWORDS:
dense gas, dispersion, modelling

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:
In progress

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT: X	SOLICITED:	PROJECT NO: 529C
INTERNAL:	GRANT:	UNSOLICITED: X	START DATE: 07/91

PROJECT TITLE:
A Long Range Transport Model of Nested Fine Resolution Grid - Phase II

SHORT TITLE:
Nested Grid Model - Phase II

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr. M. Niewiadomski
The MEP Company

LIAISON OFFICER (name,branch,section,address,telephone no.):
Dr. Chris Fung
Air Resources Branch
P.O. Box 213, 125 Resources Rd
Rexdale, Ontario M9W 5L1

(416) 235-5770

OBJECTIVE(S):
To refine and update the long range transport model developed in Phase Iand to apply the modelling system to a number of atmospheric episodes. The results will be used as inout to policy decision.

PROJECT DESCRIPTION:
In Phase I of the project, the basic framework of modelling system was established. During this poject, the meteorological preproccessor will be enhanced to allow for a larger domain covering most of southern Ontario and the modified version of ADOM will be applied to the new domain. A number of scenarios will be simulated and the results analysed with a view to addressing the feasibility of a number of emissions control scenarios.

BUDGET AND RESOURCES:

YEAR: (* current)	1*	2	3	TOTAL
COST: ($000.s)	73.8			73.8

BUDGET SOURCE: RAC TOTAL YEARS: 1

KEYWORDS:
meso scale modelling, oxidant

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: 530G
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 05/91

PROJECT TITLE:
Measurements of Natural and Anthropogenic VOCs in the Regional Atmosphere

SHORT TITLE:
Natural and Anthropogenic VOCs

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr. H. Niki
York University

LIAISON OFFICER (name,branch,section,address,telephone no.):
Mr. Ron Bell
Air Resources Branch
4th Floor, 880 Bay Street
Toronto, Ontario M5S 1Z8

(416) 326-1670

OBJECTIVE(S):
To measure atmospheric concentrations of a number of key VOCs (from C2 to C10) to evaluate relative importance of biogenic verses anthropogenic VOCs in regional oxidant problem. To gain a better understanding of atmospheric chemistry in representative Canadian rural settings as part of the Canadian Oxidant Research Program (CORP).

PROJECT DESCRIPTION:
This measurement program will be part of the CIRAC-endorsed CORP which is aimed at providing necessary scientific information for the Canadian NOx/VOC control strategy. Collection and analysis of a spatially and temporally resolvable VOC data set (Dorset, Hastings, York University, urban Toronto) during high ozone episodes as part of CORP. Investigate the viability of different sampling medium (cenisters verses absorbent cartridges) and methodologies for these applications. Extension to other important atmospheric trace gases if the results are deemed appropriate or promising.

BUDGET AND RESOURCES:

YEAR: (* current)	1*	2	3	TOTAL
COST: ($000.s)	95.0	85.0	85.0	265.0

BUDGET SOURCE: RAC TOTAL YEARS: 3

KEYWORDS:
VOCs, Canadian Oxidant Research Program, (CORP), CIRAC, NOx/VOC strategy, anthropogenic

OUTPUT (papers, presentation, reports):
Measurement of Light Hydrocarbons and Remote Sites in Ontario - CHEMRAWN VII
Measurement of Natural and Anthropogenic Volatile Organic Compounds in the Regional Atmosphere - TTC'91

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:
Steering Committee: Dr. N. Reid - ARB, Dr. B. Foster - LSB
Progress meetings every second Thursday of every other month, began Aug 8

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: 531G
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 05/91

PROJECT TITLE:
Studies of Oxidants Formation in Rural Ares of Ontario

SHORT TITLE:
Studies of Oxidants Formation in Rural Ares of Ontario

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr. D.R. Hastie
York University

LIAISON OFFICER (name,branch,section,address,telephone no.):
Dr. N.W. Reid
Air Resources Branch
4th Floor, 880 Bay Street
Toronto, Ontario M5S 1Z8

(416) 326-1691

OBJECTIVE(S):
To improve our understanding of atmospheric chemistry reading to oxidant production.

PROJECT DESCRIPTION:
Measurements will be made of a number of chemical species involved in atmospheric photochemistry. In particular, measurement of organic nitrates and other species will allow the roles of natural and anthropogenic hydrocarbons to be distinguished.

BUDGET AND RESOURCES:

YEAR: (* current)	1*	2	3	TOTAL
COST: ($000.s)	100.6	118.5	107.7	346.8

BUDGET SOURCE: RAC TOTAL YEARS: 1

KEYWORDS:
atmospheric chemistry, oxidant, measurement

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL:	CONTRACT: X	SOLICITED: X	PROJECT NO: 532G
INTERNAL: X	GRANT:	UNSOLICITED:	START DATE: 04/91

PROJECT TITLE:
Ozone Depletion by CFCs and UVB Increases Over Ontario

SHORT TITLE:

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr. W.F.J. Evans
Trent University

LIAISON OFFICER (name,branch,section,address,telephone no.):
Dr. G. Diamond
Air Resources Branch
4th Floor, 880 Bay Street
Toronto, Ontario M5S 1Z8

(416) 326-1661

OBJECTIVE(S):
1) To determine the present level of ozone depletion over Ontario due to CFC usage. 2) To predict future depletion levels over Ontario. 3) To calculate present changes in UVB levels that have occurred to date. 4) To estimate resulting skin cancer increases to date Ontario. 5) To estimate future increases in skin cancer in Ontario.

PROJECT DESCRIPTION:
The present level of ozone depletion over Ontario due to CFC usage will be determined by investigating the depletion of ozone as well as methyl chloroform. Ozone data records will be analyzed and model calculations conducted.
Model calculations will be carried out in order to predict future ozone depletion levels over Ontario. A model will be developed that will calculate present changes in UVB levels that have occurred to date. The model to estimate the resulting skin cancer rates will be developed.
The final year will be used to apply methodology to estimate the future UVB radiation damage and future increase in skin cancer rates due to this factor. This research has a direct bearing on the future health costs in Ontario.

BUDGET AND RESOURCES:

YEAR: (* current)	1*	2	3	TOTAL
COST: ($000.s)	25.0	23.0	21.0	69.0

BUDGET SOURCE: RAC TOTAL YEARS: 3

KEYWORDS:
ozone, UVB

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X CONTRACT: X SOLICITED: PROJECT NO: 533C
INTERNAL: GRANT: UNSOLICITED: X START DATE: 08/91

PROJECT TITLE:
Physical Model Simulation of Concentration Fluctuations

SHORT TITLE:
Concentration Fluctuations

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr. Anton E. Davies
RWDI Inc.

LIAISON OFFICER (name,branch,section,address,telephone no.):
Dr. C. Fung
Air Resources Branch
P.O. Box 213, 125 Resources Rd
Rexdale, Ontario M9W 5L1

(416) 235-5770

OBJECTIVE(S):
1. To retrieve and convert data from mobile industrial surveys to a PC compatible format. 2. To compare short-term concentration fluctuations measured in the field with wind tunnel simulations of the survey conditions. 3. To describe statistically, the short-term fluctuations of concentration measured in the field and in the wind tunnel. 4. To compare both field and wind tunnel concentration data with available numerical models for concentration fluctuations.

PROJECT DESCRIPTION:
Data conversion, literature review, wind tunnel simulation related to a comparison of short term concentration fluctuations between field and wind tunnel measurements.

BUDGET AND RESOURCES:

YEAR: (* current)	1*	2	3	TOTAL
COST: ($000.s)	76.0			76.0

BUDGET SOURCE: RAC TOTAL YEARS: 1

KEYWORDS:
concentration fluctuations, data conversion, simulation, wind tunnel

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: 534G
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 05/91

PROJECT TITLE:
Efflux of Trace Greenhouse Gases from Agricultural Sites into the Atmosphere

SHORT TITLE:
Trace Gases from Agriculture

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr. G.W. Thurtell
University of Guelph

LIAISON OFFICER (name,branch,section,address,telephone no.):
Mr. Al Kuja
Air Resources Branch
4th Floor, 880 Bay Street
Toronto, Ontario M5S 1Z8

(416) 456-2504

OBJECTIVE(S):
1. To optimize systems based on our proven tunable diode laser technology in order to accurately measure N_2O, NO, and CH_4 concentrations in the atmosphere and the fluxes of these gases into the atmosphere from underlying surfaces.
2. To establish the influence of soil type, climate, fertilizer additions, manure applications, cropping history and other factors on the fluxes of trace gases from agricultural field surfaces into the atmosphere.
3. To measure the flux of methane and other trace gases into the atmosphere from livestock feedlots.
4. To propose feasible ways, based on our measurements, to minimize loss of nitrogen compounds to the atmosphere from farm application of fertilizers and manure and to minimize losses of methane and other greenhouse gases from livestock operations.

PROJECT DESCRIPTION:
The initial stages of the research study entails many measurements of N_2O and CH_4 fluxes as possible during the summer and early fall of 1991. Fluxes would be measured first at the Elora Res. Stn. over pairs of treatments which could be imposed quickly (eg. urea applications, irrigation or planting of a cereal crop). Soil cores are taken. Survey type measurements at other locations and feedlots would be done. Laboratory experiments would be completed on soil cores. Instruments will be built. During the 2nd year, various planned treatments would be imposed at selected sites and fluxes of N_2O, NO, CH_4 will be measured.
At least two years of data are needed in order to provide confidence in results from field plot experiments. Laboratory work would be done to provide the background data needed to interpret the flux measurements in the field.

BUDGET AND RESOURCES:

YEAR: (* current)	1*	2	3	TOTAL
COST: ($000.s)	106.6	86.0	89.4	282.0

BUDGET SOURCE: RAC TOTAL YEARS: 3

KEYWORDS:
trace gases, greenhouse gases, agricultural

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT: X	SOLICITED:	PROJECT NO: 536C
INTERNAL:	GRANT:	UNSOLICITED: X	START DATE: 09/91

PROJECT TITLE:
Evaluation of the Capacity of Peat to Attenuate Landfill Leachate - Lanark Township Landfill Site

SHORT TITLE:
Treatment of Leachate by Peat

PRINCIPAL INVESTIGATOR AND AFFILIATION:
J.N. Dick, P.Eng.
J.L.Richards and Associates
Ottawa, Ontario

LIAISON OFFICER (name,branch,section,address,telephone no.):
A. Oda
Waste Management Branch
Technology & Site Assessment
14th Floor, 2 St Clair Ave West
Toronto, Ontario M4V 1L5

(416) 323-5129

OBJECTIVE(S):
To evaluate the capacity of peat to attenuate landfill leachate

PROJECT DESCRIPTION:
Laboratory tests will be conducted initially by allowing the leachate to permeate through columns of peat under simulated flow conditions. Collected data will be used to design a full-scale peat-filled trench. Performance of this trench will be monitored by analyzing water samples from strategically located wells and measuring hydraulic gradient across trench.

BUDGET AND RESOURCES:

YEAR: (* current)	1*	2	3	TOTAL
COST: ($000.s)	22.3	62.1		84.4

BUDGET SOURCE: RAC TOTAL YEARS: 2

KEYWORDS:
landfill leachate, peat, column tests, peat trench, design factors

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: 537G
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 05/91

PROJECT TITLE:
Centrifuge Physical Modelling of Clay Liner Compatibility

SHORT TITLE:
Landfill Liner Performance

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr. R.J. Mitchell
Queen's University

LIAISON OFFICER (name,branch,section,address,telephone no.):
Dr. George M. Hughes
Waste Management Branch
12A Floor, 2 St. Clair Ave West
Toronto, Ontario M4V 1L5

(416) 323-5216

OBJECTIVE(S):
To carry out a comprehensive evaluation of the combined effects of liner placement methods and liner-leachate compatibility using the 0.5m radius geotechnical modelling centrifuge. The initial research be carried out on laboratory prepared liner models (year 1) and that field samples of in situ compacted liners be obtained for performance evaluations following the initial research (year 2).

PROJECT DESCRIPTION:
The main purpose of this study is to produce a comprehensive suite of data on the effects of placement conditions and leachate organics on the long term performance of clay liners for waste containment. A natural illitic silty clay and a natural montmorillonitic clay would be mixed in differing proportions and subjected to compaction at two water contents under both static and kneading conditions. These compacted samples would be subjected to liner performance studies in the centrifuge apparatus under typical liner effective stress conditions and under leachate conditions varying from pure water to pure ethanol. Using four leachate conditions to define the behavioral changes would give rise to 48 models.
In the second year of the study, arrangements would be made to collect undisturbed samples. These samples would be transported to Kingston and subjected to model studies in the centrifuge. The model studies would comprise subjecting the liner models to the expected effective stress and leachate conditions over much of the life of these liners. The results would provide long term performance evaluations for the liner systems studied. It is proposed that all models be carried out as duplicate pairs such that four results would be obtained for each liner.

BUDGET AND RESOURCES:

YEAR: (* current)	1*	2	3	TOTAL
COST: ($000.s)	12.5	16.6		29.1

BUDGET SOURCE: RAC TOTAL YEARS: 2

KEYWORDS:
landfill liner, centrifuge physical modelling, clay

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT: X	SOLICITED:	PROJECT NO: 538C
INTERNAL:	GRANT:	UNSOLICITED: X	START DATE: 09/91

PROJECT TITLE:
Removal of Selenium from Copper Refinery Waste Streams

SHORT TITLE:
Selenium Recovery from Waste Waters

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr. Sydney K. Brownstein
Brownstein Consultants, on behalf of National Research Council

LIAISON OFFICER (name,branch,section,address,telephone no.):
J. Dart
Water Resources Branch
P.O. Box 213, 125 Resources Rd
Rexdale, Ontario M9W 5L1

(416) 235-5816

OBJECTIVE(S):
To identify selenium-complexing chemical groups for incorporation in ion-exchange resins suitable for abstracting selenium from wastewater streams for ultimate recovery of such selenium.

PROJECT DESCRIPTION:
Chemical groups suitable for capturing selenite (SeO3=) ions are to be identified and chemically grafted onto tailored anion-exchange resins which will be tested in their capability for removing selenium ions from both standard test solutions and actual wastewater samples. Resin performances are to be optimized, examined for performance durability and economically evaluated for wastewater applications.

BUDGET AND RESOURCES:

YEAR: (* current)	1*	2	3	TOTAL
COST: ($000.s)	38.1	40.2		78.3

BUDGET SOURCE: RAC TOTAL YEARS: 2

KEYWORDS:
ion exchange, industrial waste, treatment costs, selenium, chemical recovery, selective resin tailoring

OUTPUT (papers, presentation, reports):
Paper to be expected for the 1992 Technology transfer Conference

EXTERNAL PARTICIPATION (ministries, governments, agencies):
NRC Contributes logistic support for Brownstein Consultants

COMMENTS:
Change in NRC policy since agreement signed requires Dr. Brownstein to operate as a consultant.

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: 539G
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 05/91

PROJECT TITLE:
An Engineered Landfill Liner Utilizing Coal Ash.

SHORT TITLE:
An Engineered Landfill Liner Utilizing Coal Ash

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr. Donald Kirk
University of Toronto

LIAISON OFFICER (name,branch,section,address,telephone no.):
Mr. Mel Fielding
Waste Management Branch
14th Floor, 2 St. Clair Ave West
Toronto, Ontario M4V 1L5

(416) 323-5146

OBJECTIVE(S):
1. To demonstrate the effectiveness of the prepared coal fly ash product as an effective hydraulic and chemical barrier.
2. To determine formulations and conditions which minimize hydraulic permeability.
3. To determine the effect of water, synthetic leachate and MSW leachate on the barrier and chemical properties of the compounded material.
4. To determine anticipated life of the material through accelerated testing procedures.

PROJECT DESCRIPTION:
The research will focus on the development of low porosity structures with respect to coal fly ash produced in southern Ontario. Product formulation and characterizations will be conducted to identify key variables in developing the hydraulic barrier properties of the coal fly ash material. The formulations leading to useful hydraulic barrier properties will be quantified. The effectiveness of these materials as a physical and chemical barrier for water and synthetic leachate will be determined. Studies in the second phase involve setting up procedures and conducting tests with MSW leachate as the permeating liquid. The effect of this leachate on the chemical structure and properties of the most promising formulations will be identified. Accelerated life tests will be performed. The tests performed will demonstrate the effectiveness of these engineered barrier layers against MSW leachate and will provide data to model the life expectancy for field conditions.

BUDGET AND RESOURCES:

YEAR: (* current)	1*	2	3	TOTAL
COST: ($000.s)	33.0	28.2		61.2

BUDGET SOURCE: RAC TOTAL YEARS: 2

KEYWORDS:
coal ash, engineering, landfill liner

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: 540G
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 05/91

PROJECT TITLE:
Reduction of Nitrogen Losses from Animal Manures by Stabilization With Ammonium Adsorbing Minerals

SHORT TITLE:
Manure Nitrogen Loss Reduction

PRINCIPAL INVESTIGATOR AND AFFILIATION:
R.P. Voroney
University of Guelph

LIAISON OFFICER (name,branch,section,address,telephone no.):
Mr. Frank Iliffe
Waste Management Branch
14th Floor, 2 St. Clair Ave West
Toronto, Ontario M4V 1L5

(416) 323-5148

OBJECTIVE(S):
1. To develop an effective mineral based treatment and stabilization system of animal wastes that reduces the loss of ammonia between excretion from the animal and incorporation into the soil, increasing the nutrient value of manures and reducing the potential ground and surface water pollution from manure leachates.
2. To characterize the chemical and mineralogical composition of potentially nitrogen conserving minerals like zeolite, vermiculite and bentonite and to determine the exchange kinetics of these minerals with ammonium. To study the kinetics of N release from these charged minerals in soil. To establish connections with co-operating farmers and test the most effective minerals on farm trials.

PROJECT DESCRIPTION:
An investigation is proposed on the use of various adsorbent minerals that reduce the loss of ammonia in animal waste systems, especially in confined livestock buildings. The use of naturally occurring geological materials such as bentonite, zeolite, and vermiculite with their high adsorption and exchange capacities offer potential to increase the nutrient value of the animal manures and reduce ground and surface water pollution, specifically of manure leachates. Part 1 of the study will focus on the chemistry, mineralogy, ammonium exchange characteristics and kinetics of the mineral/ammonium system. The second part of the study will analyze the kinetics from these ammonium charged materials in soil. The final component will study farm scale tests which will determine the efficacy and practicality of these systems.

BUDGET AND RESOURCES:

YEAR: (* current)	1*	2	3	TOTAL
COST: ($000.s)	59.9	11.9		71.8
BUDGET SOURCE:	TOTAL YEARS:			

KEYWORDS:
nitrogen loss reduction, manure

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: 541G
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 05/91

PROJECT TITLE:
Remediation of Volatile Organic Compounds in Porous Media

SHORT TITLE:
Remediation of VOCs in Porous Media

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr. J.F. Sykes
University of Waterloo

LIAISON OFFICER (name,branch,section,address,telephone no.):
Mr. Ed. Rodrigues
Waste Management Branch
14th Floor, 2 St. Clair Ave West
Toronto, Ontario M4V 1L5

(416) 323-5187

OBJECTIVE(S):
To investigate through laboratory study and numerical model simulations, the influence and effectiveness of methods used to remediate VOCs that occur in both the unsaturated zone and saturated zone of porous media. The laboratory work involves column and box studies. An existing numerical model of three-phase organic-air-water flow with transport in each phase and partitioning between phases will be used for parameter calibration.

PROJECT DESCRIPTION:
This is a three year research study that will achieve the above objective by reviewing literature related to the theoretical, laboratory and field issues. A multi-phase model that can be used to analyze the laboratory and field data will be selected and revised as required. Preliminary laboratory column and box experiments will be developed. The selected two-phase flow and transport model will be used to simulate potential laboratory column and box experiments. The first year of study will initiate the development of the interaction between the water and air phase for various boundary conditions. In the second phase, laboratory column and box experiments will be used to continue the observation of the interaction between air and water in two-phase flow, and to determine the influence that variations in the water phase pressures and saturations have on the transport of a VOC in the gas phase. Separate experiments will be developed for the analysis of diffusion coefficients, adsorption coefficients and capillary pressure-water saturation relationships. The selected and revised numerical models will be used to analyze the column and box studies, experimental data; parameter calibration and model verification will also be undertaken.

BUDGET AND RESOURCES:

YEAR: (* current)	1*	2	3	TOTAL
COST: ($000.s)	46.2	48.1	51.1	145.4

BUDGET SOURCE: RAC TOTAL YEARS: 3

KEYWORDS:
VOC, porous media, remediation

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: 542G
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 05/91

PROJECT TITLE:
Chemical Oxidation of Coal Tar Residuals Below the Water Table

SHORT TITLE:
Chemical Oxidation of Coal Tar

PRINCIPAL INVESTIGATOR AND AFFILIATION:
J.F. Baker
University of Waterloo

LIAISON OFFICER (name,branch,section,address,telephone no.):
Peter McKenna
Waste Management Branch
12 A Floor, 2 St. Clair Ave West
Toronto, Ontario M4V 1L5

(416) 323-5014

OBJECTIVE(S):
To determine if strong oxidizers can chemically oxidize coal tar compounds, as what rate, and what products are generated.

PROJECT DESCRIPTION:
Laboratory experiments using and peroxide will be carried out. The oxidation products will be determined by GC/Ms analysis and approximate oxidation rates of selected coal tar organic compounds established. Second phase, laboratory experiments will study oxidation of actual coal tar using successful oxidants, Borden sand matrix and dissolved and matrix inorganics will be identified.

BUDGET AND RESOURCES:

YEAR: (* current)	1*	2	3	TOTAL
COST: ($000.s)	34.0	35.0		69.0

BUDGET SOURCE: RAC TOTAL YEARS: 2

KEYWORDS:
coal tar, oxidations, remediation

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: 543G
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 05/91

PROJECT TITLE:
Mineral Indicators for Assessing Hydraulic Connection in Buried High Permeable Zones at Waste Disposal Sites

SHORT TITLE:
Ground Water Bacteria Under Landfills

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr. M. Holder-Franklin
University of Windsor

LIAISON OFFICER (name,branch,section,address,telephone no.):
Mr. M. Young
Laboratory Services Branch
P.O. Box 213, 125 Resources Rd
Rexdale, Ontario M9W 5L1

(416) 235-5866

G. Palmateer (Acting Co-Liaison Officer)
(519) 661-2200

OBJECTIVE(S):
1. To determine the biohazards of landfill sites by establishing the hydraulic connection of high permeability zones near the Maidstone landfill.
2. The develop the rapid procedures for assessing microbiological activity in sub surface soils in order to determine the hazards associated with landfill.
3. To track the movement of bacterial populations in groundwater and soil at various depths using cultural and gene identifiers.

PROJECT DESCRIPTION:
The research involves sampling bore holes of Maidstone and nearby sites, as well as samples analyzed for chlorine - 36, radon -222, tritium. Pb and Cd. Samples are analyzed for aerobic and anaerobic bacteria and actinomycetes. Sites selection will be critical as there are ample choice, 105 holes near the landfill and several others across the country. Genetrak Systems will be set up for possible Salmonella, E. coli and Listeria. Analysis of Pb and Cd tolerant strains for plasmid genes will be conducted, along with Multivariate statistical analysis of microbiological populations.
Second season of sampling will confirm results and establish controls. The isolation of bacteria and sample analysis will continue; and a factor analysis and cluster analysis of data set will conclude the second phase of the research.
The final stage consists of the completion of development of gene probes for the loci that control Pb and Cd tolerance. These loci are than metallothionein for Pb and ATPase efflux enzyme for Cadium.

BUDGET AND RESOURCES:

YEAR: (* current)	1*	2	3	TOTAL
COST: ($000.s)	39.2	53.0	57.0	149.2

BUDGET SOURCE: TOTAL YEARS:

KEYWORDS:
landfill biohazards, hydraulic connections, high permeability zones, bio tracer

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: 544G
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 05/91

PROJECT TITLE:
Development of a Novel Procedure to Disinfect Biomedical Waste.

SHORT TITLE:

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr. P.L. Seyfried
University of Toronto

LIAISON OFFICER (name,branch,section,address,telephone no.):
Ms. L.M. Matthews
Waste Management Branch
14th Floor, 2 St. Clair Ave West
Toronto, Ontario M4V 1L5

(416) 323-5138

OBJECTIVE(S):
1. To assess the effectiveness of a novel disinfectant (VBF) against bacteria, viruses, fungi, and amoebae.
2. To alter the chemical formulation of the VBF disinfectant, should it be necessary, to improve the efficacy of the compound against specific organisms.
3. To test the ability of a new crushing machine (Bio-Nurbel 100) to reduce the volume of biohazardous waste.
4. To evaluate the use of the VBF disinfectant in the Bio-Nurbel machine as a means of reducing both the microbial content and the volume of biohazardous waste.
5. To determine the survival rates of indicator bacteria viruses, fungi and amoebae following treatment over time with the VBF disinfectant in the Bio-Nurbel machine.
6. To compare the cost and efficacy of the VBF disinfectant with that of another disinfectant sodium hypochlorite.

PROJECT DESCRIPTION:
In this research study, viral, bacterial, fungal and amoebic indicators will be used to determine the inhibitory activity of the new disinfectant VBF. Syringes, bottles, Petri plates etc. are seeded with unknown concentrations of the organisms and the material will then be processed in the Bio-Nurbel machine. The percent inhibition of the microorganisms in the liquid waste and the crushed solids will be determined. The experiments will be repeated using sodium hypochlorite as the disinfecting agent so that efficacy and cost comparisons can be made.
The results will show whether or not the Bio-Nurbel machine can effectively reduce the volume of biomedical waste. Also the disinfecting capabilities and relative cost of VBF will be established.

BUDGET AND RESOURCES:

YEAR: (* current)	1*	2	3	TOTAL
COST: ($000.s)	41.0			41.0

BUDGET SOURCE: RAC TOTAL YEARS: 1

KEYWORDS:

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: 545G
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 05/91

PROJECT TITLE:
New Process for the Recovery of Chromium from Electroplating Wastes using Liquid Membrane Pertraction

SHORT TITLE:
Chromium Recovery by Liquid Membrane Protraction

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr. Mark D. Pritzker
University of Waterloo

LIAISON OFFICER (name,branch,section,address,telephone no.):
Mr. John Smart
Waste Management Branch
14th Floor, 2 St. Clair Ave West
Toronto, Ontario M4V 1L5

(416) 323-5179

OBJECTIVE(S):
1. To evaluate liquid membrane pertraction technology as an alternative for the recovery, recycling and reuse of chromate from electroplating wastes.
2. To perform a preliminary assessment of the technoeconomic feasibility of this process compared to existing treatment processes.

PROJECT DESCRIPTION:
The first phase of this research involves the construction and testing of a liquid membrane pertraction apparatus along with the development of the analytical protocols for chromium analysis. Concurrently with this phase of the project, membrane supports will be acquired from various suppliers and their suitability evaluated. Once this phase is complete, experiments will be implemented to investigate the effects of feed, strip (acid or alkaline) and organic membrane composition. This will be followed by studies on the effects of mode of operation. The initial phase of the 2nd year involves the completion of the experiments dealing with operational optimization of the liquid membrane pertraction apparatus. Factors which will be considered and optimized will include flow rates, counter- or co-current operation and any design criteria for the apparatus which may not have been considered during its initial construction. During the latter part of this stage, the effects of more complex feed solutions (involving potential contaminants such as Cu, Ni and V) will be investigated. Finally, a mathematical model will be tested against experimental data. A technoeconomic evaluation will be completed and compared to known methods for the treatment of chromium-containing waste streams.

BUDGET AND RESOURCES:

YEAR: (* current)	1*	2	3	TOTAL
COST: ($000.s)	38.5	40.1		78.6

BUDGET SOURCE: RAC TOTAL YEARS: 2

KEYWORDS:
chromium, electroplating wastes, liquid membrane, pertraction

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: 546G
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 05/91

PROJECT TITLE:
Enhanced in Situ Bioremediation of Groundwater Contaminated with Chlorinated Solvents using a Permeable Nutrient Delivery Wall

SHORT TITLE:
Bioremediation of Chlorinated Solvants

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr. J.F. Barker
University of Waterloo

LIAISON OFFICER (name,branch,section,address,telephone no.):
Dr. George M. Hughes
Waste Management Branch
14th Floor, 2 St. Clair Ave West
Toronto, Ontario M4V 1L5

(416) 323-5216

OBJECTIVE(S):
1. To show that aerobic aquifer material can be driven sufficiently anaerobic that degradation of chlorinated solvents will occur.
2. To overcome mixing limitations within the aquifer by using a permeable wall, periodically flushed with a nutrient solution, to deliver the chemicals necessary to induce a uniformly reducing environment immediately downgradient from the wall.
3. To demonstrate the usefulness of this technology as an in situ remedial alternative in a controlled field setting.

PROJECT DESCRIPTION:
The first year of the research study will determine the parameters required to biologically drive the aerobic aquifer anaerobic and exert sufficient hydrogeological control on the aquifer/permeable wall system. Microcosm studies and in situ column studies will be performed to establish the optimum nutrient combination and concentrations; a laboratory column study will be initiated to assess practical problems and test possible solutions; a modelling study will be initiated to design of the permeable wall; a pilot scale wall will be installed at CFB Borden. In the second phase the laboratory column study assessing the practical limitations of the technique and the field tracer test will be completed. The appropriate modifications to the approach will be made. Laboratory work in microcosm and column may be continued in the second year if required. A controlled injection of solvent contacted water will take place up gradient from the wall, and the wall will be used to ensure that the nutrient solution forms a plume which encloses and mixes with the dissolved solvents.

BUDGET AND RESOURCES:

YEAR: (* current)	1*	2	3	TOTAL
COST: ($000.s)	24.6	26.2	21.7	72.5

BUDGET SOURCE: RAC TOTAL YEARS: 3

KEYWORDS:
bioremediation, chlorinated solvants

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: 547G
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 05/91

PROJECT TITLE:
Movement of Agricultural and Domestic Wastewater Bacteria Through Soils

SHORT TITLE:
Bacterial Transport through Soils

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr. H. Lee
University of Guelph

LIAISON OFFICER (name,branch,section,address,telephone no.):
Mr. M. Young
Laboratory Services Banch
P.O. Box 213, 125 Resources Rd
Rexdale, Ontario M9W 5L1

(416) 235-5866

OBJECTIVE(S):
1. To confirm in laboratory studies the suitability of using nalidixic acid resistant E. Coli as an indicator of the soil transport characteristics of naturally occurring bacteria under various conditions.
2. Laboratory study of the influence of soil types, soil conditions,application rates, waste types and reworked layer on bacterial transport through soils.
3. Determined, through field monitoring: (a) the level of bacterial contamination of surface receiving waters from the spreading of agricultural wastes on tile drained fields under various conditions; and (b) the movement of bacteria from septic tank leaching beds into the saturated zones where they may be transported to nearby shallow wells.
4. Develop (a) mathematical models of bacterial transport through soils, suitable for use over a range of soils and environmental conditions; (b) guidelines to minimize the detrimental impact of liquid agricultural waste use on surface receiving water quality; and (c) guidelines for septic tank and leaching bed installations with regard to bacterial contamination and suggest improvements.

PROJECT DESCRIPTION:
The research will use a blend of laboratory and field studies to investigate pathways and processes that contribute to bacterial movement through unsaturated soils from application of either liquid agricultural wastes or septic tank effluents, the two most prominent water-borne sources of bacteria in rural areas. Tracer bacteria and mathematical modelling, bacterial transport through natural soils with special attention on preferential flow through macropores is analyzed. The use of tracer bacteria as a tool in the search for sources and pathways of bacterial movement to surface and ground water will be confirmed. The effect of application rates, soil characteristics, waste types, and reworked layer on the transport will be evaluated. Mathematical models of bacterial transport over a range of soils and environmental conditions will be generated. The results will contribute to improved guidelines with respect to agricultural waste discharge and design of septic tank tile drain systems.

BUDGET AND RESOURCES:

YEAR: (* current)	1*	2	3	TOTAL
COST: ($000.s)	65.0	77.5	58.0	200.5

BUDGET SOURCE: RAC TOTAL YEARS: 3

KEYWORDS:
field, tile drainage, bacterial tracer, soil transport

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X | CONTRACT: | SOLICITED: | PROJECT NO: 548G
INTERNAL: | GRANT: X | UNSOLICITED: X | START DATE: 05/91

PROJECT TITLE:
Municipalities and the Environment, a One-Year Feasibility Study

SHORT TITLE:
Municipalities and the Environment

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr. A. Crowder
Queen's University

LIAISON OFFICER (name,branch,section,address,telephone no.):
Mr. George Zagarac
Policy and Planning
11th Floor, 135 St. Clair Ave West
Toronto, Ontario M4V 1P5

(416) 323-4554

OBJECTIVE(S):
(1) Provide a forum where municipalities in SE Ontario can voice and share concerns and ideas about their environmental decisions. (2) Explore possible collaboration between municipalities and Queen's Centre for Sustainable Development (QCSD). (3) Analyze municipal attitudes to the Stage 1 Plan of the Bay of Quinte Remedial Action Program. (4) Explore communication between municipalities and their public. (5) To increase the Ministry's knowledge of regional municipal attitudes.

PROJECT DESCRIPTION:
1. The research study will begin with a workshop, where discussion groups will represent small cities, rural townships and urban-rural townships each having a cross-section of QCSD members and a rapporteur. The opening talk will touch on the principles of sustainable development. Themes will be decisions which have to be taken in a context of population dynamics, increasing resource use and public 'greening', and lack of money together with an existing framework of legislation or practice at the three levels of government. Results will be a clarification of concerns and ideas on the region's environmental choices.
2. Questionnaire on RAP options. The graduate students, from the School of Urban and Regional Planning, will seek statistical and scientific advice on format, and will phone or visit to obtain introductory information and to substantiate survey findings. The sample population will represent the same three groups as in (1), for the RAP area. Questions will mostly be closed-ended, for example on perceived barriers to achieving environment/economy objectives. Results will be analysis of municipal attitudes to RAP, options, and public involvement.

BUDGET AND RESOURCES:

YEAR: (* current)	1*	2	3	TOTAL
COST: ($000.s)	16.7			16.7

BUDGET SOURCE: RAC TOTAL YEARS: 1

KEYWORDS:
municipalities, environment, feasibility study, QCSD,

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: 549G
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 05/91

PROJECT TITLE:
Development of a Computer Model to Determine Environmental Impact of Electric Vehicles in Ontario

SHORT TITLE:
Electric Vehicles and Environment

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr. W.A. Adams
University of Ottawa/ESTCO,

LIAISON OFFICER (name,branch,section,address,telephone no.):
Mr Ian Johnson
Policy and Planning
11th FLoor, 135 St. Clair Ave West
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(416) 323-4557

OBJECTIVE(S):
1) Determine emissions from operating Electric Vehicles (EVs) in Ontario (2) Determine environmental effects of replacing Internal Combustion Engine Vehicles (ICEVs) with EVs. (3) Provide net environmental impacts of EVs. (4) Develop a user-friendly program to estimate net changes in emissions for different numbers and types of EVs introduced, and ICEVs displaced. (5) Provide the Ministry with a planning tool in preparation for a wide-scale introduction of EVs into Ontario.

PROJECT DESCRIPTION:
The research study will examine all possible sources of ground level emissions caused by automobiles and power plants and estimate the amount of emissions that can be displaced by replacing ICEVs with EVs. Using experimental data obtained on electric propulsion systems at ESTCO and literature data, quantitative prediction of environmental impacts of EV introduction will be established by use of a computer model. The following factors will be examined in order to develop the computer model. 1. Source of electricity in Ontario. 2. Efficiency of electrochemical power sources and energy conversion. 3. Emissions in g/km associated with the operation of EVs.
4. Vehicle use patterns in Ontario and present emission of ICEVs.

BUDGET AND RESOURCES:

YEAR: (* current)	1*	2	3	TOTAL
COST: ($000.s)	4.5	16.3		60.8

BUDGET SOURCE: TOTAL YEARS: 2

KEYWORDS:
computer model, electric vehicles,

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT: X	SOLICITED:	PROJECT NO: 550C
INTERNAL:	GRANT:	UNSOLICITED: X	START DATE: 06/91

PROJECT TITLE:
Capital Investment Cycles and Environmental Protection

SHORT TITLE:
Investment Cycles

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr. Avery Shenfeld
Ernst and Young Management Cons.

LIAISON OFFICER (name,branch,section,address,telephone no.):
Mr. S. Southly
Policy and Planning
11th Floor, 135 St. Clair Ave West
Toronto, Ontario M4P 1V5

(416) 323-4445

OBJECTIVE(S):
Address issues related to optimal timing of environmental protection investments: 1) Evidence firms exceed current regulatory requirements during capital expansions to realize cost savings relative to complying later with a retrofit.
2) Extent that these cost advantages are offset by increased financing. 3) Are there distinct capital investment cycles that could be monitored and taken into consideration in regulatory decisions by the Ministry.

PROJECT DESCRIPTION:
The methodology for this study involves four components: 1) a review and analysis of data on environmental protection cost differences between new or substantially redesigned plants compared to retrofitting existing operations; 2) a review and analysis of available data on past capital expenditures; 3) a series of interviews with industry experts and independent industry analysts; and 4) the development of recommendations regarding the monitoring of future capital investment cycles by Ministry of the Environment.

BUDGET AND RESOURCES:

YEAR: (* current)	1*	2	3	TOTAL
COST: ($000.s)	52.4			52.4

BUDGET SOURCE: RAC TOTAL YEARS: 1

KEYWORDS:
investment cycles, environmental protection, capital expenditures,

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT: X	SOLICITED:	PROJECT NO: 551C
INTERNAL:	GRANT:	UNSOLICITED: X	START DATE: 04/91

PROJECT TITLE:
Soil Ingestion: Model Parameters for Multimedia Assessment of Heavy Metals

SHORT TITLE:
Soil Ingestion

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr. Steve Sheppard
AECL Research

LIAISON OFFICER (name,branch,section,address,telephone no.):
Mr. Scott W. Fleming
Hazardous Contaminants Branch
12th Floor, 2 St. Clair Ave West
Toronto, Ontario M4V 1L5

(416) 323-5003

OBJECTIVE(S):
1. To compare the bioavailability of heavy metals ingested with soil to that ingested.
2. To provide realistic estimates of the quality of soil retained on-hands and food products relevant to exposure scenarios.
3. To determine the characteristics of ingested soil.

PROJECT DESCRIPTION:
The first phase of the research entails the establishment of the important soil ingestion exposure pathways and scenarios. The scenarios will identify the elements, soil types, plant types, and human activities to be represented.
The first experiments deal with bioavailability, and entail implementation of methods, either from the literature or the development. The key hypothesis to test is whether elements ingested with soil are equally bioavailable to those ingested in food.
In the second year of the research the methods and knowledge gained in the first year are applied to investigate a series of soil, plant and element combinations important to the scenarios defined. The first year will provide data suitable for generic assessment application; the second year will allow the researcher to improve this data base with information specific to sol types and human activity scenarios.

BUDGET AND RESOURCES:

YEAR: (* current)	1*	2	3	TOTAL
COST: ($000.s)	76.4	46.4		122.8

BUDGET SOURCE: RAC TOTAL YEARS: 2

KEYWORDS:

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: 552G
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 07/91

PROJECT TITLE:
Contingency Planning for Accidentally Released Genetically Engineered Organisms in the Environment

SHORT TITLE:
Contingency Planning

PRINCIPAL INVESTIGATOR AND AFFILIATION:
J.T. Trevours
University of Guelph
Department of Environmental Biology

LIAISON OFFICER (name,branch,section,address,telephone no.):
J.S. Bailey
Hazardous Contaminants Branch
12th Floor, 2 St. Clair Ave West
Toronto, Ontario M4V 1L5

(416) 323-5005

OBJECTIVE(S):
To provide a detailed review of all available information on contingency planning applied to genetically engineered organisms (GEMs). To undertake laboratory simulations of environmental spills of GEMs in order to monitor their fate and dissemination and to investigate and develop appropriate physical and chemical methods for their control.

PROJECT DESCRIPTION:
The aim of this study is to provide regulatory agencies with information and or protocols which can be incorporated into contingency plans for the accidental release of genetically engineered microorganisms. The first objective is to provide a detailed review of available knowledge in the area. This is to be followed with a series of laboratory simulations of accidental releases and spills in order to model the fate of GEMs under various environmental conditions. Various experimental methods which may be useful in destroying or containing released organisms will than be evaluated. These tests will make known the discovered possibilities of maintenance of environmental quality in situations where biotechnology products containing viable organisms are released to the environment.

BUDGET AND RESOURCES:

YEAR: (* current)	1*	2	3	TOTAL
COST: ($000.s)	30.0			30.0?

BUDGET SOURCE: RAC TOTAL YEARS: 3

KEYWORDS:
contingency plans, genetically engineered microorganisms, microcosm

OUTPUT (papers, presentation, reports):
None to date

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X | CONTRACT: | SOLICITED: | PROJECT NO: 553G
INTERNAL: | GRANT: X | UNSOLICITED: X | START DATE: 07/91

PROJECT TITLE:
Development of the Trap-Treatment-Release Techniques for Pesticide Minimized Termite Colony

SHORT TITLE:
Termite Trap-Treatment-Release Techniques

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr. T.G. Myles
University of Toronto

LIAISON OFFICER (name,branch,section,address,telephone no.):
Mr. Geoff Cutten
Hazardous Contaminants Branch
12th Floor, 2 St. Clair Ave West
Toronto, Ontario M4V 1L5

(416) 323-5117

OBJECTIVE(S):
Investigate post-release effects under simulated soil conditions in observation arenas
1. Observe saprophytic processes on dead termites with time lapse video
2. Observe behavioral responses of untreated termites (cannibalism,walling off)
3. Determine extent of gallery blockage by fungal growth on dead termites

PROJECT DESCRIPTION:
A Trap-Treat-Release techniques for killing whole colonies of subterranean termites is proposed. The technique involves trapping several hundred thousand termites from buried rolls of cardboard. The trapped termites are treated in the laboratory with small doses of chemicals, insect growth regulators, nematodes, or by physical means. A massive number of treated termites are released back into the colony and their delayed death should cause the whole colony to die. Various designs of mass trapping systems and massive mark-released-recapture studies are planned determine how to best deliver the delayed-mortality inducing treatment. A wide array of treatments including irradiations, chemical materials, insect growth regulators, biological agents, and modes of application will be evaluated in a series of tests to compare their suitability for this approach. The transmissibility, and etiology of post-release effects will be studied in soil gallery arenas which simulate field conditions. Field trials will also be conducted.

BUDGET AND RESOURCES:

YEAR: (* current)	1*	2	3	TOTAL
COST: ($000.s)	50.0			50.0

BUDGET SOURCE: RAC TOTAL YEARS: 1

KEYWORDS:
subterranean termites, Trap-Treat_Release, delayed-mortality, laboratory, etiology

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: 554G
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 05/91

PROJECT TITLE:
Biological Risk Due to Mixtures of Hazardous Chemicals

SHORT TITLE:
Risk Assessment of Mixtures

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr. D.M. Logan
York University

LIAISON OFFICER (name,branch,section,address,telephone no.):
Dr. David Rokosh
Water Resources Branch
P.O. Box 213, 125 Resources Rd
Rexdale, Ontario M9W 5L1

(416) 235-5970

OBJECTIVE(S):
Equations of the formula (Response [A + B] = [Response A + Response B] x [1 + KAB Log A over B]) can predict the biological response due to pairs of chemicals under certain conditions. These conditions include: (a) the chemicals are both promutagens or one is a promutagen and the other is non-mutagenic, and (b) the test assays are either The Ames assay (including activation) or the mouse micronucleus assay (activation not required). The objective of the study is to extend this analysis in two directions, first, to pairwise mixtures involving other types of mutagen e.g. direct acting; and second, to extrapolate the procedure to mixtures of 3,4,5 ..... components, i.e. more "natural" systems. A manual determination of the biological response to a three component mixture is successful and more complex mixtures should be analyzed.

PROJECT DESCRIPTION:
The research study will achieve the above objectives by:
1. Ames and Micronucleus Assays of pairwise chemical combinations will be repeated (where only poor data is available). Assays involve differing proportions of the test chemicals.
2. Selected three chemical assays will be completed, in particular (BaP plus DBMA) and one other chemical (initially seven three component) mixtures will be tested.
3. The data obtained will be analyzed by the proposed interaction equations.

BUDGET AND RESOURCES:

YEAR: (* current)	1*	2	3	TOTAL
COST: ($000.s)	8.8			8.8

BUDGET SOURCE: RAC TOTAL YEARS: 1

KEYWORDS:
biological mix, hazardous chemicals, risk

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: 555G
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 05/91

PROJECT TITLE:
Analysis of Photooxidation Polycyclic Hydrocarbons (PAH) Under Environmentally Relevant Conditions and Interactions of Photomodified PAH with Higher Plants

SHORT TITLE:

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr. B.M. Greenberg
University of Waterloo

LIAISON OFFICER (name,branch,section,address,telephone no.):
Mr. Bryan Leece
Hazardous Contaminants Branch
12th Floor, 2 St. Clair Ave West
Toronto, Ontario M4V 1L5

(416) 323-5113

OBJECTIVE(S):
To continue research on the interaction of polycyclic aromatic hydrocarbons (PAH) with higher plants by investigating the production and toxic effects of photomodified PAH.

PROJECT DESCRIPTION:
This research study consists of three aspects, PAH modification by solar radiation, limits of assimilation of photooxidized PAH by Lemna gibba and toxicity of specific photooxidized PAH to higher plants. The kinetics and products of PAH photooxidation are examined under environmentally relevant conditions using quantities of UVa and UVb less than or equal to those found in sunlight.
The kinetics and limits of assimilation of isolated PAH photooxidation products by Lemna will be quantified. The toxicity of specific photomodified PAH to higher plants is also evaluated. The data obtained in this study will be useful for establishing policies concerning PAH in ecotoxicological settings, evaluating entry of modified contaminants into the food chain and developing Lemna as a bio-remediation process.

BUDGET AND RESOURCES:

YEAR: (* current)	1*	2	3	TOTAL
COST: ($000.s)	40.3			40.3

BUDGET SOURCE: RAC TOTAL YEARS: 1

KEYWORDS:
photooxidation, Polycyclic Aromatic Hydrocarbons, PAH, Lemna gibba

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:
Work is progressing fairly close to schedule with completion expected as planned

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT: X	SOLICITED:	PROJECT NO: 556C
INTERNAL:	GRANT:	UNSOLICITED: X	START DATE: 05/91

PROJECT TITLE:
Heavy Metals in Soils - A Multimedia Risk Assessment Model for Regulatory Use

SHORT TITLE:
Model Validation for Contaminants Transport in Soil

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr. Marsha Sheppard
Atomic Energy of Canada Ltd.

LIAISON OFFICER (name,branch,section,address,telephone no.):
Mr. Richard Aucoin
Hazardous Contaminants Branch
Standards Development Section
135 St. Clair Ave West
Toronto, Ontario M4V 1P5

(416) 323-5134

OBJECTIVE(S):
To assess the performance of the SCEMR (Soil Chemical Exchanges and Migration of Radionuclides) model and demonstrate its usefulness in assessing soil remediation techniques and its role in multi-media risk assessment.

PROJECT DESCRIPTION:
The performance of the solute transport model SCEMR will be assessed using input data from a few real or likely scenarios dealing with heavy metal contamination in Ontario soils. The long-term migration of the contaminants of concern (e.g. lead) will be predicted and, depending on performance of the model, the usefulness of SCEMR in predicting the long-term impact of soil remediation techniques will be demonstrated for one or more scenarios.

BUDGET AND RESOURCES:

YEAR: (* current)	1*	2	3	TOTAL
COST: ($000.s)	31.0			31.0

BUDGET SOURCE: RAC TOTAL YEARS: 1

KEYWORDS:
heavy metals, risk assessment, models, soil remediation

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):
AECL 50%

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: 568G
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 05/91

PROJECT TITLE:
Development of Inductively Coupled Plasma Mass Spectrometry for the Determination of Trace Metals in Environmental Samples

SHORT TITLE:
Flow Injection ICP-MS

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr. Diane Beauchemin
Queen's University

LIAISON OFFICER (name,branch,section,address,telephone no.):
Dr. D. Boomer
Laboratory Services Branch
P.O. Box 213, 125 Resources Rd
Rexdale, Ontario M9W 5L1

(416) 235-5858

OBJECTIVE(S):
1. To improve the analytical capabilities of ICP-MS. The expansion of ICP-MS is constrained by its limitations.
2. Research is directed toward overcoming some of them by making simple modifications to the operating conditions: i.e. using flow injection. The resulting techniques will have an extended range of applications, allowing the direct trace element analysis of a wide variety of environmental samples, including those containing high concentrations of salts.

PROJECT DESCRIPTION:
Flow injection (FI) will be used to improve the analytical capabilities of inductively coupled plasma mass spectrometry (ICP-MS). Using FI techniques, smaller samples are required, high concentrations of salts can be tolerated and matrix effects may be either reduced or eliminated. FI into a gas carrier (instead of water) is studied in an attempt to further improve the advantages of coupling FI with ICP-MS. This approach offers the advantage of no dispersion of the sample in the carrier i.e. no reduction in sensitivity compared to continuous-flow analysis. It also drastically reduces the solvent load in the plasma which increases the energy available for the various processes involving the analyte (i.e. desolvation, vaporisation, atomization and ionization) and should result in improved sensitivity, especially for elements with high ionization potential (such as As, Zn and Cd). Various parameters are studied to find the best conditions for the determination of various elements. FI-ICP-MS will be applied to the analysis of various certified reference materials (e.g. natural waters and biological materials).

BUDGET AND RESOURCES:

YEAR: (* current)	1*	2	3	TOTAL
COST: ($000.s)	23.5			23.5

BUDGET SOURCE: RAC TOTAL YEARS: 1

KEYWORDS:
flow injection, FI, ICP-MS, desolvation, vaporisation, atomization and ionization

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT: X	SOLICITED:	PROJECT NO: 569C
INTERNAL:	GRANT:	UNSOLICITED: X	START DATE: 09/91

PROJECT TITLE:
The Thermal Desorption of Solid Phase Extraction Columns for the Low Level Measurement of Organic Compounds in Water

SHORT TITLE:
Analysis of Organic Compounds in Water Using SPE/Thermal Desorption

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Marc Charbonneau
Paralel Laboratories Ltd.

LIAISON OFFICER (name,branch,section,address,telephone no.):
Mr. Partrick W. Crozier
Laboratory Services Branch
Drinking Water Organic Section
P.O. Box 213, 125 Resources Rd
Rexdale, Ontario M9W 5L1

(416) 235-5911

OBJECTIVE(S):
The development of an analytical method for the low level detection of thermal stable organic compounds in water, which will:
1. Improve analytical accuracy
2. Reduce present analytical detection limits while using reduced sample volumes
3. Increase sample through put and be amenable to automation
4. Decrease organic solvent use in the laboratory

PROJECT DESCRIPTION:
The first stage of the study will be the development of a viable technique to directly introduce analyses from a SPE column to a gas Chromatograph. The technique will be optimized for analyte recovery and interference reduction after which precision and accuracy testing will take place. The second stage of the study will consist of comparing the newly developed technique, using real samples, with the more traditional solvent extraction methods typically used to analyze for semi-volatile thermally stable organic compounds.

BUDGET AND RESOURCES:

YEAR: (* current)	1*	2	3	TOTAL
COST: ($000.s)	70.0			70.0

BUDGET SOURCE: RAC TOTAL YEARS: 1

KEYWORDS:
solid phase extraction (SPE), thermal desorption, organics, water

OUTPUT (papers, presentation, reports):
1991 Technology Transfer Conference (talk or poster)
Ministry Queen Report
Possible Journal Publication

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:
In progress as of Sept 1, 1991

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT: X	SOLICITED:	PROJECT NO: 570C
INTERNAL:	GRANT:	UNSOLICITED: X	START DATE: 10/91

PROJECT TITLE:
Piolet Study for the Development of a Biological Certified Reference Material for Organochlorine Contaminants

SHORT TITLE:
Development of a CRM: Organochlorine in Biological Material

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr. K.W. Michael Siu
National Research Council

LIAISON OFFICER (name,branch,section,address,telephone no.):
Ms. Sylvia Cussion
Laboratory Services Branch
Trace Organics Section
P.O. Box 213, 125 Resources Rd
Rexdale, Ontario M9W 5L1

(416) 235-5842

OBJECTIVE(S):
To undertake a piolet study which will identify a suitable biological material for use as a certified reference material for organochlorine compounds. Develop the appropriate processing methods, initiate storage and transport studies of this material and identify possible deficiencies in methodologies.

PROJECT DESCRIPTION:
Initial work will involve the collection of suitable biomaterial (sources in Ontario) and confirmation of levels of organochlorine contaminants. Large batches of material will then be processed by a dry and slurry approach and than packaged. Shelf life and transportation studios will be initiated. Validation as a reference material will than take place using several analytical techniques and reference laboratories.

BUDGET AND RESOURCES:

YEAR: (* current)	1*	2	3	TOTAL
COST: ($000.s)	55.3			55.3

BUDGET SOURCE: RAC TOTAL YEARS: 1

KEYWORDS:
certified reference material (CRM), organochlorine compounds,

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: 571G
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 04/91

PROJECT TITLE:
Development of Particle Beam Mass Spectrometric Methods for the Determination of Environmental Contaminants

SHORT TITLE:

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr. Ian D. Brindle
Brock University

LIAISON OFFICER (name,branch,section,address,telephone no.):
Mr. Eric Reiner
Laboratory Services branch
P.O. Box 213, 125 Resources Rd
Rexdale, Ontario M9W 5L1

(416) 235-5893

OBJECTIVE(S):
1. To construct a HPLC-MS Particle Beam Interface
2. Evaluate detection limits and library searching for carbamates and phenoxy acids
3. Investigation of spiked environmental samples
4. Investigation of unknowns

PROJECT DESCRIPTION:
A particle beam source will be developed for the high resolution Mass Spectrometer (Kratos concept). The system will be optimized for sensitivity and the ability to search library spectra. Compounds such as carbamates and phenoxy acid derivatives will be used to optimize the system. The system will than be used to determine the structures of environmental contaminants.

BUDGET AND RESOURCES:

YEAR: (* current)	1*	2	3	TOTAL
COST: ($000.s)	75.3	48.0		123.3

BUDGET SOURCE: RAC TOTAL YEARS: 2

KEYWORDS:
particle beam, LC/MS, environmental analysis

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: 572G
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 04/91

PROJECT TITLE:
A Microwave Interrupted - Flow Digestion System

SHORT TITLE:
MIFDS

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr. E.D. Salin
McGill University

LIAISON OFFICER (name,branch,section,address,telephone no.):
Mr. Raymond McVicars
Laboratory Services Branch
P.O. Box 213, 125 Resources Rd
Rexdale, Ontario M9W 5L1

(416) 235-5860

OBJECTIVE(S):
Develop safe methods and equipment for the rapid automated preparation of samples for instrumental analysis.

PROJECT DESCRIPTION:
This is a three year study that will achieve the above objectives by: testing the first mechanical prototype with real vegetation samples under lab conditions. The fully automated system will be tested at McGill. Methodologies are then developed for geological (sediment) samples.
The second phase involves the testing of both the hardware and software, as well as the development of the second automated prototype with multiple sample capability and automated slurry generation. The range of applicable sample types will be further explored in conjunction with MOE and a benefit/cost analysis.
The final phase sees the first automated prototype being integrated into the second, and the final testing and recommendations is undertaken.

BUDGET AND RESOURCES:

YEAR: (* current)	1*	2	3	TOTAL
COST: ($000.s)	44.0	39.5	41.0	124.5

BUDGET SOURCE: RAC TOTAL YEARS: 3

KEYWORDS:
microwave, digestion, automation, rapid

OUTPUT (papers, presentation, reports):
1. An apparatus for rapid microwave sample decomposition (MOE Technology Conference, Nov. 1990)
2. A rapid stopped-flow microwave digestion system (paper submitted for publication)

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT: X	SOLICITED:	PROJECT NO: 573C
INTERNAL:	GRANT:	UNSOLICITED: X	START DATE: 07/91

PROJECT TITLE:
Development of DNA Probe(s) for the Detection of Bifidobacterium ssp. in Water: Phase II

SHORT TITLE:
DNA Probes and Bifodobacterium

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr. R. Lifshitz
Beak Consulting Ltd.

LIAISON OFFICER (name,branch,section,address,telephone no.):
Mr. Gary Palmateer
Southwestern Region
985 Adelaide Street South
London, Ontario N6E 1V3

(519) 661-2268

OBJECTIVE(S):
The objectives of the research are:
the non-radioactive labelling of putative probes;
1. to confirm specificity of probes with reference strains;
2. to confirm specificity of probes with fresh environmental isolates; and
3. to analyze environmental samples (spiked) directly with DNA probes.

PROJECT DESCRIPTION:
The development of reliable DNA probes for Bifidobacterium is a major step towards rapidly and cost-effectively establishing the sources of bacterial pollution and thus distinguishing between human and animal pollution.
This research will ascertain the effectiveness (the desired specificity) of the potential probe(s); and determine the sensitivity and specificity of the probe(s) for environmental samples. The following steps will be followed to achieve the above objectives: 1. Mark putative DNA probes with non-radioactive markers. 2. Filter hybridization analysis of putative probes. Isolation and identification of Bifidobacterium spp. from fresh environmental samples. 4. Validation of DNA probe(s) with environmental samples.

BUDGET AND RESOURCES:

YEAR: (* current)	1*	2	3	TOTAL
COST: ($000.s)	49.5			49.5

BUDGET SOURCE: RAC TOTAL YEARS: 1

KEYWORDS:
DNA probes, Bifodobacterium,

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X | CONTRACT: | SOLICITED: | PROJECT NO: 574G
INTERNAL: | GRANT: X | UNSOLICITED: X | START DATE: 05/91

PROJECT TITLE:
Unique Flow Injection Sample Introduction for Plasmas Spectrometry

SHORT TITLE:

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr. Eric D. Salin
McGill University
Chemistry Dept.

LIAISON OFFICER (name,branch,section,address,telephone no.):

Ms. Pamela Moss
Laboratory Services Branch
I.T.C.
P.O. Box 213, 125 Resources Rd
Rexdale, Ontario M9W 5L1

(416) 235-6084

OBJECTIVE(S):
To develop a flow injection interface for atomic spectrometry. The benefits are expected to be:
1. Factors of 100 - 1000 improvement in detection limit
2. Increased sample throughput
3. Reduction of elimination of matrix effects
4. Reduction in per sample cost

PROJECT DESCRIPTION:
The research study of three years involves the testing of real samples as well as the testing of the limits of the columns. Also begin the development of an automated FIA-DSI on the ICP-MS at the MOE and start ETV-FIA-ICP systems.
The second phase of the research is designated to test the FIA-ETV-ICP system. Start FIA-ETV spray injector development, start speciation studies. In the final stage, the best system, ETV or DSI, should be determined by comparative studies on a variety of samples and a solid FIA (DSI or ETV) interface will be settled on.

BUDGET AND RESOURCES:

YEAR: (* current)	1*	2	3	TOTAL
COST: ($000.s)	48.0	47.5	49.5	145.0

BUDGET SOURCE: RAC TOTAL YEARS: 3

KEYWORDS:
flow injection analysis, atomic spectrometry, sample introduction, eletrothermal vaporization, inductively coupled plasma

OUTPUT (papers, presentation, reports):
presentation at SSC in August in Ottawa

EXTERNAL PARTICIPATION (ministries, governments, agencies):
None

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT: X	SOLICITED:	PROJECT NO: 575C
INTERNAL:	GRANT:	UNSOLICITED: X	START DATE: 08/91

PROJECT TITLE:
Regionalization of Low Flow Characteristics for the Northeastern and Northwestern Regions

SHORT TITLE:
Regionalization of Low Flow Characteristics

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Mr. H.S. Belore
Cumming Cockburn Ltd.

LIAISON OFFICER (name,branch,section,address,telephone no.):
Dr. Lloyd Logan
Water Resources Branch
4th Floor, 1 St. Clair Ave West
Toronto, Ontario M4V 1K6

(416) 323-4898

OBJECTIVE(S):
1. To test available methodologies for predicting low flows in the Northeastern and Northwestern regions. To identify suitable techniques for application and required research/refinements.
2. Test the statistical series available for trend and randomness and develop an appropriate data base for predicting low flows.
3. Refine multivariate analysis, graphical and index method techniques for predicting low flows.
4. Integrated findings with previous investigations.

PROJECT DESCRIPTION:
This research study will test existing and develop new techniques to estimate extreme value low flows for ungauged watersheds in the Northeastern and Northwestern regions of Ontario.
Optional investigation would also be undertaken if selected (biologically-based low flows and comparative analysis).
Primary and secondary methods will be identified and ranked for accuracy in predicting low flow estimates. Previous studies of this nature have identified many avenues of research requiring further study. Additional research required to develop an overall prediction methodology for Ontario would be identified.

BUDGET AND RESOURCES:

YEAR: (* current)	1*	2	3	TOTAL
COST: ($000.s)	55.0	67.0		122.0

BUDGET SOURCE: RAC TOTAL YEARS: 2

KEYWORDS:
low flow, regionalization, NE, NW,

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: 576G
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 05/91

PROJECT TITLE:
Mercury Flux and Bioconcentration

SHORT TITLE:
Mercury Flux and Bioconcentration

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Mr. Donald McQueen
York University

LIAISON OFFICER (name,branch,section,address,telephone no.):
Dr. Greg Mierle
Water Resources Branch
Bellwood Acres Road
Dorset, Ontario P0A 1E0

(416) 766-2418

OBJECTIVE(S):
The primary objective of this study is to quantify the impacts on rates and pathways of mercury bioaccumulation, of shifts in community structure induced by "top-down" changes in piscivore and planktivore abundance and to compare these impacts with the effects of "bottom-up" factors including chemistry and geochemistry. A specific objective is to test the hypothesis that planktivore dominated communities with small bodied zooplankton and small phytoplankton (and therefore high residence times for contaminants), are likely to have higher mercury concentrations than piscivore dominated communities with large zooplankton and high rates of sedimentation. A subsidiary objective is to test the contrasting hypotheses that rates of mercury bioaccumulation are inversely related to piscivore growth rate and that mercury concentrations in piscivores are directly related to food-chain length.

PROJECT DESCRIPTION:
The research study will begin pre-manipulation assessment (fish, zooplankton, phytoplankton, benthos, water with chemistry, flux rates, production rates, mercury and other trace metal concentrations) of Ranger Lake, Plastic Lake and Mouse Lake. Comparison with data collection for these and Little Clear Lake. Establishing a sediment trap and sedimentation calculation protocol. The second year will continue with the analysis of mercury (and selected trace metals) analysis for fish, selected benthic invertebrates, size selected phytoplankton and zooplankton, water and sediment. The final stages involves reciprocal transfer manipulations of piscivores and planktivores in Mouse and Ranger Lakes. Continued monitoring of Plastic (control) and Harp Lakes. Addition of Blue chalk to the data set. Focusing on size fractioning zooplankton and phytoplankton for mercury analysis and on size fractioned zooplankton Haney grazing experiments to determine which portions of the phytoplankton size spectrum are consumed by zooplankton, as well as dynamics and bioenergetics.

BUDGET AND RESOURCES:

YEAR: (* current)	1*	2	3	TOTAL
COST: ($000.s)	41.7	41.7	41.7	125.1

BUDGET SOURCE: RAC TOTAL YEARS: 3

KEYWORDS:
mercury flux, bioconcnetration,

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X | CONTRACT: | SOLICITED: | PROJECT NO: 577G
INTERNAL: | GRANT: X | UNSOLICITED: X | START DATE: 07/91

PROJECT TITLE:
Fate of Volatile Organic Compounds in Wastewater Collection Systems

SHORT TITLE:
Fate of Volatiles in Sewers

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr. Richard Sorsi
University of Guelph

LIAISON OFFICER (name,branch,section,address,telephone no.):
Mr. Rob Paine
Water Resources Branch
7th Floor, 1 St. Clair Ave West
Toronto, Ontario M4V 1K6

(416) 323-4992

OBJECTIVE(S):
There are four objectives as follows:
1. Determine importance of competing fate mechanisms for VOCs in sewers
2. Estimate gas-liquid partitioning of VOC's in sewers by experimentation
3. Develop a computational model for determining fate of VOCs in sewers
4. Apply the computational model to an actual collection system.

PROJECT DESCRIPTION:
Field research will be carried out on various operating sewer reaches to determine the fate of volatile compounds. Fate mechanisms to be studied will include gas-liquid transfer, biodegradation and adsorption. Sewers in Metropolitan Toronto will be used for field experiments to estimate mass loading from industrial sources. Results from field studies will be used to develop a computational model to estimate VOC fate in sewers.

BUDGET AND RESOURCES:

YEAR: (* current)	1*	2	3	TOTAL
COST: ($000.s)	61.5	42.2	57.8	161.5

BUDGET SOURCE: RAC TOTAL YEARS: 3

KEYWORDS:
volatile organic compounds (VOC), fate, sewers, model

OUTPUT (papers, presentation, reports):
At end of project output will include;
a VOC computational fate model and user documentation, a final report, student theses and possible published paper(s).

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: 578G
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 06/91

PROJECT TITLE:
Hydrogeology of Oak Ridges Moraine (ORM)

SHORT TITLE:

PRINCIPAL INVESTIGATOR AND AFFILIATION:
K.W.F. Howard
University of Toronto

LIAISON OFFICER (name,branch,section,address,telephone no.):
Mr. Sam Singer
Water Resources Branch
Drinking Water Section
4th Floor, 1 St. Clair Ave West
Toronto, Ontario M4V 1K6

(416) 323-4882

OBJECTIVE(S):
1. Develop a detailed hydrostatigraphy for the ORM
2. Develop a comprehensive understanding of the hydrogeologic behaviour of the ORM; and
3. Develop a 2-D groundwater flow model for the ORM

PROJECT DESCRIPTION:
1. Collection and synthesis of existing geo-environmental data in form of GIS database, completion of deep borehole drilling, sampling, logging and instrumentation and seismic reflection studies, reconstruction of bedrock topography and detailed stratigraphy. Begin geochemical and isotropic studies of sampling waters.
2. Development of hydrostratigraphy for the ORM. Selection and implementation of appropriate model.
3. Completion of geochemical and isotopic studies. Refinement of model.

BUDGET AND RESOURCES:

YEAR: (* current)	1*	2	3	TOTAL
COST: ($000.s)	104.6	56.2	57.7	218.5

BUDGET SOURCE: RAC TOTAL YEARS: 3

KEYWORDS:
Oak Ridges Moraine, hydrostratigraphy, hydrogeology, ORM groundwater flow model, isotope, seismic

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):
Steering committee includes MOE Central Region, MNR

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT: X	SOLICITED:	PROJECT NO: 579C
INTERNAL:	GRANT:	UNSOLICITED: X	START DATE: 05/91

PROJECT TITLE:
Spatial and Temporal Analysis of the Occurrence of Barbicide Residue in a Major Southern Ontario Agricultural Watershed

SHORT TITLE:
Analysis of Herbicides in Agricultural Watersheds

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Mr. Robert Walker
Beak Consultants Ltd.

LIAISON OFFICER (name,branch,section,address,telephone no.):
Dr. Lloyd Logan
Water Resources Branch
4th Floor, 1 St. Clair Ave West
Toronto, Ontario M4V 1K6

(416) 323-4898

OBJECTIVE(S):
The objectives of the research are:
1. The validation of Enzyme Linked Immunosorbent Assay Techniques for detection of atrazine in water;
2. To determine immunoassay applicability for water monitoring;
3. To establish relationships between atrazine runoff and spatial factors;
4. To establish relationships between atrazine runoff and temporal factors; and
5. To establish guidelines for designing herbicide monitoring program.

PROJECT DESCRIPTION:
Three water quality monitoring sites will be established in a Southern Ontario agricultural watershed. These will represent areas ranging from the whole watershed to a small headwater area. Runoff event and interevent water samples will be taken prior to, during and following atrazine use periods for triazine analysis by two methods (gas chromatography (GC) and immunoassay technique). The immunoassay technique will be evaluated by comparison to the GC method. Atrazine runoff characteristics will be related to spatial factors including watershed size and land use information and temporal factors including season and runoff timing.

BUDGET AND RESOURCES:

YEAR: (* current)	1*	2	3	TOTAL
COST: ($000.s)	54.0			54.0

BUDGET SOURCE: RAC TOTAL YEARS: 1

KEYWORDS:
herbicide, watershed, barbicide,

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: 580G
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 05/91

PROJECT TITLE:
Chromium in Lakes of Ontario

SHORT TITLE:
Chromium in Lakes

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr. Jerome O. Nriagu
University of Waterloo

LIAISON OFFICER (name,branch,section,address,telephone no.):
Dr. Peter Dillon
Water Resources Branch
Bellwood Acres Road
Dorset, Ontario P0A 1E0

(705) 766-2418

OBJECTIVE(S):
1. To determine the principal processes and pathways that regulate the distribution of Cr(II) and Cr(VI) in lake ecosystems of this province. The kinetics of Cr(III) oxidation to the more toxic Cr(VI) is very slow but can be catalyzed by H_2O_2 in the water. Large quantities of H_2O_2 are now being used by many industries and in the treatment of domestic and industrial wastewaters and sewage effluents.
2. To determine the fate and life-time of the industrial H_2O_2 Cr speciation. For many lakes, the dominant source of pollutant Cr is the atmosphere. We will determine, probably for the first time, the dissolved versus particulate concentrations as well as the Cr(VI):Cr(III) ratios in rainfall of this province. The sample collection and analyses will be done using the ultra-clean laboratory techniques.

PROJECT DESCRIPTION:
This is a three year research study which will achieve its objectives by: a) establishing an analytical protocol to measure the total Cr, Cr(III), Cr(VI) and organochromium concentrations in water; b) setting up a portable system to be used in the field for measuring the concentrations of H_2O_2 in water samples; C) collecting and processing samples from Lakes Erie and Ontario.
The second stage of the research involves the set up of the rain collectors; samples from 8-12 lakes in the Dorset or Sudbury region -- lakes are to be selected to provide a range in pH, colour and redox conditions; and measuring the H_2O_2 concentrations in water samples.
The final phase consists of the completion of collection and analysis of rainfall and snowfall samples.

BUDGET AND RESOURCES:

YEAR: (* current)	1*	2	3	TOTAL
COST: ($000.s)	19.8	19.8	19.8	59.4

BUDGET SOURCE: RAC TOTAL YEARS: 3

KEYWORDS:
chromium, Ontario, H202,

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: 581G
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 05/91

PROJECT TITLE:
Nitrate Persistence in Slightly Permeable Sediments in Ontario

SHORT TITLE:
Nitrate in Till

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr. R.W. Gillham
University of Waterloo

LIAISON OFFICER (name,branch,section,address,telephone no.):
Mr. W. Blackport
West central Region
P.O. Box 2112
12th Floor, 119 King Street West
Hamilton, Ontario L8N 3Z9

(416) 521-7703

OBJECTIVE(S):
1. To establish the mobility and persistence of NO_3 within a variety of slightly permeable overburden materials in Southern Ontario.
2. To evaluate the usefulness of techniques that provide geochemical evidence for the denitrification reaction so that easy-to-use field techniques for establishing environments of NO_3 attenuation can become widely used by hydrogeologists. This information then leads to a knowledge of what geologic environments are capable of attenuating NO_3 contamination from septic systems.

PROJECT DESCRIPTION:
This three year research study will begin by establishing the mobility and persistence within the till units of the Cambridge and Kintore Creek study sites, by obtaining a continuous or semi-continuous core or cores to depths of 2-10 m into the till units. Detailed profiles of porewater NO_3 and tritium will then be obtained by squeezing the cored material. Tritium will be used to age-date the porewaters so that a correlation of groundwater age and land use history can be used to determine if NO_3 is migrating in the till units at the same velocity as the groundwater. In addition, at each core location a multiple piezometer nest will be installed to establish the vertical hydraulic gradient within the till units and to provide additional groundwater samples for determination of redox conditions. The physical properties of the till material will be established including determination of hydraulic conductivity, grain size distribution, carbonate content and content of oxidizable constituents such as solid phase organic carbon and sulphide minerals.

BUDGET AND RESOURCES:

YEAR: (* current)	1*	2	3	TOTAL
COST: ($000.s)	56.5	56.5	56.5	169.6

BUDGET SOURCE: RAC TOTAL YEARS: 3

KEYWORDS:
nitrate, till, sediments, Ontario

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: 582G
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 05/91

PROJECT TITLE:
An Integrated NPS Model for Watershed Planning

SHORT TITLE:
NPS Model of Water Quality

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr. R.P. Rudra
University of Guelph

LIAISON OFFICER (name,branch,section,address,telephone no.):
Mr. Keith Willson
Water Resources Branch
4th Floor, 1 St. Clair Ave West
Toronto, Ontario M4V 1K6

(416) 323-4820

OBJECTIVE(S):
1. To achieve preselected provincial water quality goals the watershed is a link between the region and the field. There is a need for an integrated model for watershed planning with an eye on the environment - a model which is continuous in nature, addresses the contribution to water quality from surface and tile drained flow, takes into account spatial and temporal variability of soil properties, aud addresses the impact of tile drainage on soil and downstream siltation.
2. To develop a watershed scale nonpoint source pollution model, applicable to Ontario conditions, for the transport of sediment, nutrients and pesticides, in surface and tile drained water, in particulate and solution form, from agricultural watershed.

PROJECT DESCRIPTION:
In the course of this research project, an integrated watershed model will be developed - providing a description of the processes involved, a tool for the determination of significant factors (and combinations of factors), and a means for evaluating remedial measures -- for surface runoff, tile drainage, soil erosion and transport, nutrient transport and pesticide transport from small agricultural watersheds. This model will be formulated on the basis of watershed models developed and tested at Guelph (i.e. GAMES, GAMESP, GAWSER), and result from a major field scale modelling exercise (funded through an NSERC Strategic Research Grant) presently underway at the School of Engineering. Model calibration and validation will be performed predominantly with data bases assembled by personnel working on other projects (i.e. Agriculture Canada research, SWEEP projects), through co-operative arrangements. Preliminary analysis will be undertaken with the model to explore such topics as the sensitivity of outputs to changes in input variables and parameters, and the likely relative impacts of selected remedial practices.

BUDGET AND RESOURCES:

YEAR: (* current)	1*	2	3	TOTAL
COST: ($000.s)	69.0	69.0	69.0	207.0

BUDGET SOURCE: RAC TOTAL YEARS: 3

KEYWORDS:
NPS model, watershed planning,

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT: X	SOLICITED:	PROJECT NO: 583C
INTERNAL:	GRANT:	UNSOLICITED: X	START DATE: 08/91

PROJECT TITLE:
Documentation of the Biological Community of Polishing Ponds (Sutton Concept Sewage Treatment System)

SHORT TITLE:
Sutton System, Polishing Pond, Pond Ecology

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Mr. Jeff T. Graham
Henderson, Paddon Environmental Inc.

LIAISON OFFICER (name,branch,section,address,telephone no.):
Mr. Doug Huber
Southwestern Region
985 Adelaide Street South
London, Ontario N6E 1V3

(519) 661-2260

OBJECTIVE(S):
1. To describe the aquatic ecology of the polishing pond component of the "Sutton Concept" extended aeration treatment system.
2. To link the physical and chemical environment of the polishing pond and its effect on the structure and composition of the biological community.
3. To determine the importance of pond ecology in maintaining and achieving high quality effluent for the "Sutton Concept" system.
4. To assist potential development of enhanced bio-removal of phosphorus and use of animal/algae byproduct for animal feeds etc.

PROJECT DESCRIPTION:
This research study includes the investigation and description of biological community of polishing pond in "Sutton Concept" sewage treatment system. This is followed by identifying and quantifying abundance and seasonal distribution of plant and animal groups or species. The following stage requires the conducting of summer, fall and winter field work. Complete measurements of relevant physical and chemical parameters and review of existing data will then be under taken.

The final stage of the research involves complete field investigation of the biological, physical and chemical parameters.

BUDGET AND RESOURCES:

YEAR: (* current)	1*	2	3	TOTAL
COST: ($000.s)	27.9	38.3		66.2

BUDGET SOURCE: RAC TOTAL YEARS: 2

KEYWORDS:
Sutton System, polishing pond, pond ecology,

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT: X	SOLICITED:	PROJECT NO: 584C
INTERNAL:	GRANT:	UNSOLICITED: X	START DATE: 08/91

PROJECT TITLE:
Development of a Geographic Information System Application for Water Quality Management and Policy Development

SHORT TITLE:
GIS Application for Water Quality Management

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Mr. T.E. Cooper
Cumming Cockburn Ltd

LIAISON OFFICER (name,branch,section,address,telephone no.):
Mr. Brian Whitehead
Water Resources Branch
4th Floor, 1 St. Clair Ave West
Toronto, Ontario M4V 1K6

(416) 323-4828

OBJECTIVE(S):
1. To utilize a digital data base to be incorporated in available GIS computer software.
2. To develop an application model which would be incorporated in GIS to aid watershed managers in the environmental assessment of land use changes and resulting impact on water quality.
3. To evaluate the performance of the GIS and application models for water quality management and policy development and make recommendations for future research and development.
4. To identify an implementation strategy for GIS use in MOE for water quality management.

PROJECT DESCRIPTION:
The project would be initiated with an extensive review of current research and existing GIS applications in water quality management. Data acquisition and processing of the data would be then be undertaken on one of three watersheds currently experiencing water quality deterioration due to agricultural development. The spatial water quality model would be developed and applied to the test basin. A final report would then state conclusions of the study and make recommendations regarding future research requirements in enhancing the GIS application.

BUDGET AND RESOURCES:

YEAR: (* current)	1*	2	3	TOTAL
COST: ($000.s)	63.5			63.5

BUDGET SOURCE: RAC TOTAL YEARS: 1

KEYWORDS:
GIS, water quality,

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT: X	SOLICITED:	PROJECT NO: 585C
INTERNAL:	GRANT:	UNSOLICITED: X	START DATE: 08/91

PROJECT TITLE:
Performance Review of Perforated Pipe-Grass swale Stormwater Drainage Systems.

SHORT TITLE:

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr. Paul Wisner, P.Eng.
Paul Wisner and Associates

LIAISON OFFICER (name,branch,section,address,telephone no.):
Weng Yan Liang
Water Resources Branch
4th Floor, 1 St. Clair Ave West
Toronto, Ontario M4V 1K6

(416)

OBJECTIVE(S):
1. To determine currently employed design practices in Ontario for the design of perforated pipe systems, by a) an inquiry with consulting system designers and pipe manufacturers, b) by monitoring the installation of a typical system and c) a thorough review of recent literature.
2. To determine the performance of typical grass swale-perforate pipe systems through a series of infiltration-exfiltration tests, and the effect of catch basin baffles on performance; field tests would determine infiltration rates for the swale and exfiltration rates for the pipe and would include continuous flow and precipitation monitoring. Changes in groundwater level and quality are also monitored.
3. To calibrate an existing computational model which predicts the performance of the grass swale-perforated pipe combination, for the determination of the hydraulics of the perforated pipe to allow the calibration of the computational model.

PROJECT DESCRIPTION:
The research study will commence with a review of existing literature related to perforated pipes - grass swales and the implementation of a consultant and municipality inquiry into system use. The installation of a system being built will be monitored. This will result in a set of guidelines and recommendations on design, construction & maintenance of these systems. In consultation with the Ottawa-Carleton MOE office, a study site will be selected where performance tests will be performed. Results of this phase will be infiltration/exfiltration rates for the system as well as contaminant loadings to the receiving waters and the resultant groundwater effects. Finally, the hydraulic characteristics of the system will be determined through hydraulic laboratory studies a the University of Ottawa. Results of the testing will be used in calibrating an existing computer model for grass swale-perforated pipe system design.

BUDGET AND RESOURCES:

YEAR: (* current)	1*	2	3	TOTAL
COST: ($000.s)	73.0			73.0

BUDGET SOURCE: RAC TOTAL YEARS: 1

KEYWORDS:
stormwater drainage, perforated pipe, cross swale, infiltration, exfiltration, construction and maintenance, design guidelines, computer modelling

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: 586G
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 05/91

PROJECT TITLE:
Benthic Invertebrates as Indicators of the Efficacy of a Heavy Metal Contaminants Cleanup

SHORT TITLE:
Ecosystem Approach to Sediment Remediation

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Mr. Mike Dickman
Brock University

LIAISON OFFICER (name,branch,section,address,telephone no.):
Mr. Robert J. Slattery
West Central Region
P.O. Box 2112
12th Floor, 119 King Street West
Hamilton, Ontario L8N 3Z9

(416) 384-9896

OBJECTIVE(S):
To map the distribution of abnormal invertebrates as it relates to heavy metal contamination levels in the sediments in an area of concern (AOC) from upstream and downstream of the Atlas Specialty Steels Ltd. clean-up area. To evaluate the synergistic impact of heavy metals on the frequency of chironomid labial plate deformities.

PROJECT DESCRIPTION:
The research begins with the removal of replicated Ponar samples from each of the stations decided on by the Welland Office of the MOE. In addition, a Control Site will be sampled for purposes of comparison, before and after the proposed clean-up. This is followed by chemical analysis of tissues with GC/MS and estimation of frequency of chironomid deformities and benthic invertebrate diversity.
The second year of work involves post clean-up benthic invertebrate sampling programme to determine the efficacy of the clean-up in terms of the reduction in the frequency of chironomid abnormalities and the increase in species diversity in a provincially significant riverine wetlands.
Finally, the removal of replicated Ponar samples will be undertaken, from each of the stations decided on by Welland Office of the MOE. A chemical analysis of chironomid tissues with GC/MS, and an estimation of frequency of chironomid deformities and benthic invertebrate diversity.

BUDGET AND RESOURCES:

YEAR: (* current)	1*	2	3	TOTAL
COST: ($000.s)	19.6	18.9	18.4	56.9

BUDGET SOURCE: RAC TOTAL YEARS: 3

KEYWORDS:
benthic invertebrates, GC/MS, heavy metal,

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT: X	SOLICITED:	PROJECT NO: 587C
INTERNAL:	GRANT:	UNSOLICITED: X	START DATE: 08/91

PROJECT TITLE:
An Ontario Test Case of Economic Instruments in Support of Environmental Protection Goals

SHORT TITLE:
Economic Instruments

PRINCIPAL INVESTIGATOR AND AFFILIATION:
E.A. Gowan
Apogee Research Institute Ltd.

LIAISON OFFICER (name,branch,section,address,telephone no.):
Ms. O. Salamon
Financial Planning Branch
8th Floor, 135 St Clair Ave West
Toronto, Ontario M4P 1V5

(416) 323-4561

OBJECTIVE(S):
The purpose of this research project is to design and assess an Ontario test case of using economic instruments to contribute to achieving water quality environmental goals. This test case would then be used to assist in the determination of whether or not such instruments were of benefit and the situations in which they could be expected to be most useful to the Province and the government.

PROJECT DESCRIPTION:
The study begins with the selection of a test case watershed. Water quality pollution problems at the site will be identified geographically and by type of impairment, as well as by class of pollutant. The pollution sources are documented, and remediation and abatement options for each source of pollution will be identified. Each option will be described and the costs and their distributions will be used to determine the potential for economic instruments. The second task is to determine the potential for economic instruments for each class of pollutant and contributing sector. This is linked with the assessment of the possible instruments in terms of pre-selected variables, until a preferred set of instruments is selected.
The third task involves the design and implementation schedule for the test case at the site. The final stage is preparation and planning a workshop at which the parties affected by the test case would be invited to review the results of the research.

BUDGET AND RESOURCES:

YEAR: (* current)	1*	2	3	TOTAL
COST: ($000.s)	46.0			46.0

BUDGET SOURCE: RAC TOTAL YEARS: 1

KEYWORDS:
economic instruments

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: 588G
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 09/91

PROJECT TITLE:
Corporate Codes and the Principles of Sustainability

SHORT TITLE:

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr. Max B.E. Clarkson
University of Toronto

LIAISON OFFICER (name,branch,section,address,telephone no.):
Mr. Joel Kurtz
Research and Technology Branch
135 St. Clair Ave. West
12th Floor
Toronto, Ontario M4V 1P5

(416) 323-4484

OBJECTIVE(S):
The objective of the study is to produce a written report to the Ontario Roundtable on the Economy and the Environment which will assist the roundtable in encouraging the use of codes of sustainability in Ontario industry.

PROJECT DESCRIPTION:
This study will outline the types of codes used in companies and will analyze the extent to which codes are used in Canadian corporations. The study will reveal how the ethics and values of sustainable development are expressed in extent codes and how the principles of sustainable development might best be incorporated into company codes.

BUDGET AND RESOURCES:

YEAR: (* current)	1*	2	3	TOTAL
COST: ($000.s)	5.0			5.0

BUDGET SOURCE: TOTAL YEARS:

KEYWORDS:
corporate codes, Principles of Sustainability

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT: X	SOLICITED:	PROJECT NO: 590C
INTERNAL:	GRANT:	UNSOLICITED: X	START DATE: 09/91

PROJECT TITLE:
Review of the Toxicity of Diazinon to Birds

SHORT TITLE:

PRINCIPAL INVESTIGATOR AND AFFILIATION:
G.L. Stephenson
Ecological Services for Planning Ltd.

LIAISON OFFICER (name,branch,section,address,telephone no.):
Mr Doug Mewett
OPAC
5th Floor, 135 St. Clair Ave. West
Toronto, Ontario M4V 1P5

(416) 323-4552

OBJECTIVE(S):
The objective of this study is to ascertain the locations, frequency and extent of waterfowl poisoning events associated with turfgrass management in the US and Canada.

PROJECT DESCRIPTION:
The research study will with a literature search, review of and assessment the data available on the effects of liquid and granular formulations of diazinon on birds. This is followed by a comparison and contrasting of poisoning incidents in Ontario versus the US in light of chemical formulation, application rates, methods of application, environmental characteristics, species of waterfowl affects, timing of application relative to life history characteristics of the affected birds, other turf practices, etc.; and, lastly, discussing the implications of our assessment on current use patterns of diazinon in Ontario.

BUDGET AND RESOURCES:

YEAR: (* current)	1*	2	3	TOTAL
COST: ($000.s)	10.6			10.6

BUDGET SOURCE: RAC TOTAL YEARS: 1

KEYWORDS:
toxicity, birds, diazinon

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT: X	SOLICITED:	PROJECT NO: 591C
INTERNAL:	GRANT:	UNSOLICITED: X	START DATE: 09/91

PROJECT TITLE:
Review of the Fate and Effects of TBTO

SHORT TITLE:

PRINCIPAL INVESTIGATOR AND AFFILIATION:
G.L. Stephenson
Ecological Services for planning Ltd.

LIAISON OFFICER (name,branch,section,address,telephone no.):
Mr Doug Mewett
OPAC
5th Floor, 135 St. Clair Ave. West
Toronto, Ontario M4V 1P5

(416) 323-4552

OBJECTIVE(S):
The objective of this research study is to compile a literature review that will aid in the assessment of the consequences of TBTO (tributyl tin oxide), still used as a reservative of wood.

PROJECT DESCRIPTION:
The research objective will be achieved by reviewing the primary literature and assessing:
1) the sources, occurrence and characteristics of TBTO,
2) its persistence, fate and dissipation in terrestrial and aquatic environments,
3) the potential for bioaccumulation, bioconcentration and biomagnification;
4) the toxicity of TBTO to non-target terrestrial and aquatic organisms (acute, chronic, reproduction, carcinogenicity, oncogenicity, teratogenicity and mutagenicity), and,
5) identifying human health concerns.

BUDGET AND RESOURCES:

YEAR: (* current)	1*	2	3	TOTAL
COST: ($000.s)	8.9			8.9

BUDGET SOURCE: RAC TOTAL YEARS: 1

KEYWORDS:
TBTO

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED: X	PROJECT NO: PDF05G
INTERNAL:	GRANT: X	UNSOLICITED:	START DATE: 07/89

PROJECT TITLE:
Development of FT-IR Special Database for Artificial Intelligence Assisted Toxic Environmental Pollutants Analysis

SHORT TITLE:
FT-IR Database of Environmental Pollutants

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr. J. Semmler
University of Waterloo

LIAISON OFFICER (name,branch,section,address,telephone no.):
Dr. Paul Young
Air Resources Branch
Trace Organic Section
P.O. Box 213, 125 Resources Rd
Rexdale, Ontario M9W 5L1

(416)235-6004

OBJECTIVE(S):
1. To enhance current infrared spectral data base with:
a) Condensed and gas phase infrared spectra of 75 polychlorinated biphenyl (PCB) congeners, 14 chlorobenzenes (CB) and 48 polyaromatic hydrocarbon (PAH) isomers.
b) Condensed phase infrared spectra of about 500 proprietary commercial products collected by the TOS.
2. To develop artificial intelligence based computer software for library search and structural prediction use.

PROJECT DESCRIPTION:
A fast accurate, and high sensitivity principal component identification analytical techniques is required for;
1. On-site hazardous wastes characterization and remedial action.
2. Investigative purpose, i.e.,inspection of transported industrial materials/wastes at border crossing effluents.
3. Real time monitoring of industrial effluents.
Infrared spectometry offers both qualitative and quantitative information of all constituents in the sample. Functional group information is used for identification. Advantages of modern infrared spectometers (o.e., Fourier transform infrared (FT-IR) spectometer) include: ease of sample preparation; high sensitivity; and digitized spectra for rapid library search and identification. All of these make FT-IR spectrometry an attractive solution to the above requirements.
There are now over 54,000 digitized reference spectra commercially available for on-line library search purposes. Library search software is readily available to make the best use of these library spectra. It is common, however, that problems does arise from the use if commercial infrared libraries and library search and structural prediction software. The causes of these problems are: a) insufficient library entries in the infrared data base and b. library search and structural prediction software are designed to perform analysis to a limited number of references of high purity (higher than 95%). Environmental samples, on the other hand, can be received as complex mixtures.
In this proposal, we are requesting research funding of one Postdoctoral Fellow (PDF) and one cooperative student to conduct development work to solve the above problems.

BUDGET AND RESOURCES:

YEAR: (* current)	1	2	3*	TOTAL
COST: ($000.s)	45.0	51.0		96.0

BUDGET SOURCE: RAC TOTAL YEARS: 2

KEYWORDS:
FT-IR, artificail; intelligence, environmental pollutants, databsae

OUTPUT (papers, presentation, reports):
3 publications; 3 presentations, Vapour Phase Library; AI Software Interpretation package

EXTERNAL PARTICIPATION (ministries, governments, agencies):
University of Waterloo

COMMENTS:
Project 100% completed, 2 months behind schedule

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: PDF06G
INTERNAL:	GRANT:	UNSOLICITED: X	START DATE: 06/91

PROJECT TITLE:
GC/GC/MS Analysis of Ambient Air VOCs amd PAHs

SHORT TITLE:
Airborne PAHs Analysis

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr. V.M. Kanagasabapathy
Post Doctoral Fellowship

LIAISON OFFICER (name,branch,section,address,telephone no.):

Mr. Ron Bell
Air Resources Branch
4th Floor, 880 Bay Street
Toronto, Ontario M5S 1Z8

(416) 326-1670

Dr.P. Yang
Laboratory Services Branch
P.O. Box 213, 125 Resources Rd
Rexdale, Ontario M9W 5L1

(416) 235-6004

OBJECTIVE(S):
Quantitative Analysis of airborne volatile and semi-volatile organic compounds employing super critical fluid extraction (SFE), multi-dimensional gas chromatography (MDGC), flame ionization and mass selective (FID-MSD) without involving problematic clean-up stages; thereby generating Quality Assurance/Quality Control Standard Operating Procedures (QA/QC SOP) for the routine measurement of ambient air concentrations.

PROJECT DESCRIPTION:
Air pollution arises mainly because of the presence of mutagenic and carcinogenic PAHs. To understand the extent of human exposure to PAHs, reliable sampling and analytical methodology have to be evolved for monitoring the minute concentrations of PAHs in air. To preconcentrate these trace contaminants to levels commensurate with existing state-of-the-art analytical methodologies, high-volume air sampling with the use of back-up polyurethane foam or XAD-2 resin has been proposed. However, for the quantitative recovery of the contaminants from other sorbents such as carbosieves, flyash, SFE (an excellent rapid alternative to soxhlet extraction) is being investigated. To clear up the obstacles such as coelution and random shift of analyte's retention times, MDGC techniques such as heart-cutting and back-flushing will be employed. To accomplish complete characterization of PAHs, electron impact as well as negative chemical ionization mass spectrophotometric (EI/GC/MC - NCI/C/MS) techniques will be pursued.

BUDGET AND RESOURCES:

YEAR: (* current)	1*	2	3	TOTAL
COST: ($000.s)	44.5	43.5		58.0

BUDGET SOURCE: RAC TOTAL YEARS: 2

KEYWORDS:
Polycyclic Aromatic Hydrocarbons, PAHs, high-volume sampling, supercritical fluid extraction, multidimensional gas chromatography, mass selective detector

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):
Office of Research Admin., University of Toronto

COMMENTS:

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RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: PDF08G
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 06/91

PROJECT TITLE:
Advanced Instrumental Techniques for the Qualitative and Quantitative Determination of Trace Organic Pollutants

SHORT TITLE:
Advanced Instrumental Techniques - TOCs

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Ms. Koester
Trent University

LIAISON OFFICER (name,branch,section,address,telephone no.):
Mr. Vince Taguchi
Laboratory Services Branch
P.O. Box 213, 125 Resources Rd
Rexdale, Ontario M9W 5L1

(416) 235-5902

OBJECTIVE(S):
1. Optimize automated system for dioxin/furan congener group determinations.
2. Adapt automated system for toxic isomer-specific dioxin/furan congener determination.
3. Investigate use of automated system for determination of PCBs, chlorobenzenes, chlorophenols, and other organics in addition to dioxins/furan using the same sample extract.
4. Characterize new system with respect to speed of analysis, reproducibility, efficiency, detection limits, and applicability to a wide variety of sample types including fish, industrial effluent, pulp sludge, sewage sludge, soils, and stack emissions.
5. Prepare report on operation, applicability, and characteristics of new methodology. Prepare bench method documentation.

PROJECT DESCRIPTION:
The automated sample preparation and LC-MS equipment will be initially evaluated by using standards. Analysis time, detection limits, analyte recovery, precision, and applicability to various compounds classes will be determined. Comparisons between GC-MS and LC-MS techniques, and between electrospray and particle-beam LC-MS interfaces will be made. The final stages of research will include the analysis of a variety of real environmental samples.

BUDGET AND RESOURCES:

YEAR: (* current)	1*	2	3	TOTAL
COST: ($000.s)	45.0	45.0		90.0

BUDGET SOURCE: RAC TOTAL YEARS: 2

KEYWORDS:
TOC

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

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RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: PDF09G
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 07/91

PROJECT TITLE:
Development of a Cost-Effective Process for the Production of Beta-Glucosidase

SHORT TITLE:
Production of Beta-Glucosidase/Cost-Effective Process

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr. Morris Wayman, Dr. A. Singh
University of Toronto

LIAISON OFFICER (name,branch,section,address,telephone no.):
Mr. Mel Fielding
Waste Management Branch
14th Floor, 2 St. Clair Ave West
Toronto, Ontario M4V 1L5

(416) 323-5146

OBJECTIVE(S):
The objective is to develop a cost-effective process for the production of beta-glucosidase, and the production of cellulase enzymes.

PROJECT DESCRIPTION:
To initiate and carry through, to at least a one to ten litre scale the synthesis of low cost beta-glucosidase.
To establish its usefulness in the bioconversion to ethanol and volume reduction of the paper in municipal solid waste.

BUDGET AND RESOURCES:

YEAR: (* current)	1*	2	3	TOTAL
COST: ($000.s)	13.0	13.0		26.0

BUDGET SOURCE: RAC TOTAL YEARS: 2

KEYWORDS:
Beta-Glucosidase, cost-effective process

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: E557G
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 05/91

PROJECT TITLE:
Development of a Novel Photocatalytic Reactor for Mineralization of Water Pollutants

SHORT TITLE:
Novel Photocatalytic Reactor

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr. H. de Lasa
The University of Western Ontario

LIAISON OFFICER (name,branch,section,address,telephone no.):
Mr. Patrick Cheung
Water Resources Branch
P.O. Box 213, 125 Resources Rd
Rexdale, Ontario M9W 5L1

(416) 235-5825

OBJECTIVE(S):
1. To develop at the conceptual level a novel design for a photocatalytic reactor configuration involving embedded TiO2 in glass mesh with specific features in terms of fluid dynamics conditions, TiO2 loading in the mesh and reactor illumination.
2. To build one prototype of this novel photocatalytic reactor unit in order to establish the main favourable characteristics of the proposed design. The prototype unit will have a scale and will be operated under conditions such that the results of the research will provide a good basis for future scaling up and commercialization of this concept.
3. To test the new design with non-reactive tracers and model pollutants in order to confirm the various characteristics of the proposed design and the expected high performance of this photocatalytic reactor.
4. To maintain and expand contacts with a number of industrial companies associated with the CREC-UWO in order to secure the relevance of the results of this program and to create the conditions for a large implementation of this new concept in phases that will follow this program.

PROJECT DESCRIPTION:
A novel photochemical reactor concept will be developed. These activities will also include computations of geometric and design characteristics of the proposed unit, flow patterns through screens, between screens, illumination of screens and effects of TiO2 loadings. CAD drawings of the proposed reactor will be prepared. The unit will be manufactured in the Mechanical Shop-UWO, assembled and tested at the CREC-UWO. A first series of experiments with model pollutants and various concentrations levels of these pollutants will be conducted and reactants, products, including various intermediates will be quantified.The photocatalytic reactor will be modified as suggested by the first set of experiments. The second series of experiments will also be conducted in the modified set up using eventually a second model pollutant. Analytical determination of reactants and products, including various reaction intermediates, will provide conclusive indicators about high performance, kinetic parameters and mechanistic interpretations.

BUDGET AND RESOURCES:

YEAR: (* current)	1	2*	3	TOTAL
COST: ($000.s)	114.8			114.8

BUDGET SOURCE: Cleansweep TOTAL YEARS: 1.5

KEYWORDS:
Novel Photocatalytic Reactor

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: E558G
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 05/91

PROJECT TITLE:
A Study of the Contamination of Suspended Fluvial Sediments with Enteric Bacteria in Agricultural Drains

SHORT TITLE:
Bacterial Sediment Absorption

PRINCIPAL INVESTIGATOR AND AFFILIATION:
David Hayman
Upper Thomas River Conservation Authority

LIAISON OFFICER (name,branch,section,address,telephone no.):
Karen Jones
Water Resources Branch
4th Floor, 1 St. Clair Ave West
Toronto, Ontario M4V 1K6

(416) 323-4819

OBJECTIVE(S):
1.To characterize the suspended sediments according to size, concentration and type in three different watercourses which are impacted by agricultural waste.
2.To determine the degree of colonization of suspended sediment particulates by E. coli and Salmonella sp using direct viable cell count and immunofluorescence microscopy procedures.
3.To determine the relationship between the suspended particulate surface area and the numbers of total viable bacteria with respect to seasonal differences including weather and land use activities.
4.To determine the distance travelled by sediment sorbed fecal associated bacteria in various agricultural drains.
5.To determine the concentrations of surface sediment associated nutrients such as soluble carbon, nitrogen and phosphorus in comparison to the respective nutrient concentrations in the surrounding water column.

PROJECT DESCRIPTION:
Three agricultural drains are chosen as study sites based on their size and whether the drains are impacted with manure. At each location, suspended stream sediments will be analyzed to determine the degree of colonization by enteric bacteria originating in the manure. The survivability and distance transported downstream will be determined along with the concentrations of nutrients associated with the sediments.

BUDGET AND RESOURCES:

YEAR: (* current)	1*	2	3	TOTAL
COST: ($000.s)	35.0			35.0

BUDGET SOURCE: Cleansweep TOTAL YEARS: 1

KEYWORDS:
suspended sediment, bacteria, colonization, agricultural

OUTPUT (papers, presentation, reports):
Finding of previous stages of this work (430, 512) have had final reports, poster sessions, (Technology Transfer Conferences 1990, SWCSA 1991, AEAO). Required progress reports are being submitted every 4 months.

EXTERNAL PARTICIPATION (ministries, governments, agencies): MOE SW Region

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X | CONTRACT: | SOLICITED: | PROJECT NO: E559G
INTERNAL: | GRANT: X | UNSOLICITED: X | START DATE: 06/91

PROJECT TITLE:
Fate of Contaminants in Municipal Pollution Control Plants

SHORT TITLE:

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr. D. Mackay
University of Toronto

LIAISON OFFICER (name,branch,section,address,telephone no.):
Mr. Scott Abernethy
Water Resources Branch
P.O. Box 213, 125 Resources Rd
Rexdale, Ontario M9W 5L1

(416) 235-5803

OBJECTIVE(S):
1. Compile and analyze data on chemical "treatability" in plants
2. Fit data to a steady-state model
3. Modify model based on data and in QSAR information
4. Estimate "treatability" of untested chemicals

PROJECT DESCRIPTION:
A through literature survey will be undertaken including discussions with the primary groups in this area (EPA, Washington and Cincinnati, CCIW, McMaster, Clemson, Syracuse, etc.). This will ensure that we are at the "state of the art". The data fitting and analysis will be undertaken.

BUDGET AND RESOURCES:

YEAR: (* current)	1*	2	3	TOTAL
COST: ($000.s)	39.0			39.0

BUDGET SOURCE: Cleansweep TOTAL YEARS: 2

KEYWORDS:
Municipal, fate, QSAR, model, treatability

OUTPUT (papers, presentation, reports):
1. Scientific paper
2. Progress Report
3. Model on diskette for MOE
4. Model user workshop

EXTERNAL PARTICIPATION (ministries, governments, agencies):
none

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: E560G
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 05/91

PROJECT TITLE:
Mechanisms of the Photodegradation of Organic Pollutants from Wastewaters in Homogeneous and Heterogeneous Systems using Ultraviolet Light

SHORT TITLE:
Photodegradation of Aqueous Organic Pollutants

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr. James Bolton
University of Western Ontario

LIAISON OFFICER (name,branch,section,address,telephone no.):
Mr. Anthony Edmonds
Water Resources Branch
4th Floor, 1 St. Clair Ave West
Toronto, Ontario M4V 1K6

(416) 323-2759

OBJECTIVE(S):
1. To employ spin trapping with electron paramagnetic resonance (EPR) spectroscopy as a technique to examine the primary photoprocesses in the photodegradation of organic pollutants by direct photolysis, and by homo- and heterogeneous photocatalysis.
2. To develop a table of rate constants for the reaction of .OH radicals with a wide variety of organic pollutants.
3. To expand and develop the technique of flash photolysis with HPLC detection with application to the study of the mechanism of the photodegradation of organic pollutants in wastewaters.

PROJECT DESCRIPTION:
This research study will be divided into two phases; The first will utilize the technique of spin-trapping with electron paramagnetic resonance detection to determine the rate constants for the reaction of .OH radicals with pollutant molecules in both homogenous and heterogeneous systems.
Direct photolysis systems will also be examined. The second phase will use the technique of flash photolysis in the photolysis of various pollutants.

BUDGET AND RESOURCES:

YEAR: (* current)	1	2*	3	TOTAL
COST: ($000.s)	147.2			147.2

BUDGET SOURCE: Cleansweep TOTAL YEARS: 1.5

KEYWORDS:
Photodegradation of Organic Pollutants

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X | CONTRACT: | SOLICITED: | PROJECT NO: E561G
INTERNAL: | GRANT: X | UNSOLICITED: X | START DATE: 03/91

PROJECT TITLE:
Remote Detection of Hydrocarbon Fuel Contaminants in the Subsurface

SHORT TITLE:

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr. J.D. Redman
University of Waterloo

LIAISON OFFICER (name,branch,section,address,telephone no.):
Sid Emami
Water Resources Branch
4th Floor, 1 St. Clair Ave West
Toronto, Ontario M4V 1K6

(416) 323-4874

OBJECTIVE(S):
To provide a sound physical basis for evaluating the effectiveness of electrical property based geophysical methods and for improving the interpretation of survey data obtained with these methods. An assessment will be made of the applicability of the ground penetrating radar and conductivity mapping techniques to detect hydrocarbons.

PROJECT DESCRIPTION:
1st phase; Construction of a columnar test cell, than measure vertical profiles of electrical properties of soil columns with and without hydrocarbon fuels. Further studies, based on the results of the work completed in the first phase, will be completed using the soil columns and natural solid cores.

BUDGET AND RESOURCES:

YEAR: (* current)	1*	2	3	TOTAL
COST: ($000.s)	52.1			52.1

BUDGET SOURCE: Cleansweep TOTAL YEARS: 1.5

KEYWORDS:
hydrocarbon detection

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:
Interim Report will be sent to MOE Jan 1992

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: E562G
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 05/91

PROJECT TITLE:
Evaluation of a Streptococcus Faecium subsp. casseliflavus Model to Assess Pollution Sources at the Kelso Conservation Area

SHORT TITLE:

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr. P.L. Seyfried
University of Toronto

LIAISON OFFICER (name,branch,section,address,telephone no.):
Mr. M. Young
Laboratory Services Branch
P.O. Box 213, 125 Resources Rd
Rexdale, Ontario M9W 5L1

(416) 235-5866/323-4651

OBJECTIVE(S):
1. To characterize the Streptococcus Faecium subsp. casseliflavus organism isolated from wildlife and farm animals in the Kelso Conservation area.
2. To establish whether distinguishing characteristics of the S. casseliflavus isolated can be used to assist in the identification of different animal fecal pollution sources.
3. To evaluate the impact on the Kelso beach from animal sources by monitoring stations in the Hilton Falls forest during storm events and dry weather.
4. To examine the seasonal variation in S. casseliflavus recovery and establish whether or not high levels of the organism can be recovered from the sediment of Sixteen Mile Creek.
5. To assess the feasibility of using an Escherichia coli : Streptococcus casseliflavus ratio model to determine if the pollution sources are human or animal in nature.

PROJECT DESCRIPTION:
The first phase of this research study entails the sampling areas on Sixteen Mile Creek at: (a) the location that receives effluent from the Miltonsewage treatment plant; (b) sites with farmland runoff; (c) the Halton Falls forest; and (d) the Kelso Conservation Area Beach. Water, sediment and fecal samples will be collected from the sites once a week for a period of three months. Thereafter, samples will be collected bi-monthly to assess seasonal variations in the recovery of indicator organisms.
Levels of S. casseliflavus, fecal coliforms and E. coli will be determined in all samples collected. The water samples will be analyzed for P. aeruginosa as well. Characterization of the S. casseliflavus organisms isolated from different animals and a variety of sources will be done using biochemical testing. A minimum of 2000 S. casseliflavus isolates will be examined and comparisons made. The Ec/Sc model will be evaluated using data from all the sites.

BUDGET AND RESOURCES:

YEAR: (* current)	1*	2	3	TOTAL
COST: ($000.s)	37.0			37.0

BUDGET SOURCE: Cleansweep TOTAL YEARS: 1

KEYWORDS:
pollution source, fecal contamination, bacterial ratio, S. Faecium subsp. casseliflavus

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: E563G
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 05/91

PROJECT TITLE:
Comparison of Liquid Manure Practices on Tile Drain Water Quality

SHORT TITLE:

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Donna Dean
Ausable Bayfield Conservation Authority

LIAISON OFFICER (name,branch,section,address,telephone no.):
Murray Blackie
Southwest Region
985 Adelaide Street South
London, Ontario N6E 1V3

(519) 661-2200

OBJECTIVE(S):
1.To compare the irrigation and injection methods of liquid manure application and determine their relative impact on tile drain water quality.
2.To compare manure application at different crop stages, (ie. pre-crop, during crop and post-crop), and determine their relative impact on tile drain water quality.
3.To compare manure application on soil with different surface treatments, (ie. fall plowed and prepared seed bed), and determine their relative impact on tile drain water quality.
4.To monitor groundwater contamination, with piezometers, in conjunction with each of the above mentioned objectives.
5.To compare bacterial and chemical components of composted liquid manure versus conventional liquid manure, if time permits.

PROJECT DESCRIPTION:
The research study incorporates the following schedules: The manure application trials will be conducted on the same field. Observation chambers, possibly with automatic samplers, will allow water samples and discharge measurements to be taken directly from the tile drains. One observation chamber will be used as a control while the others will be used for trials. Three field trials will be conducted, one in spring, summer, and fall respectively.

BUDGET AND RESOURCES:

YEAR: (* current)	1*	2	3	TOTAL
COST: ($000.s)	98.0			98.0

BUDGET SOURCE: Cleansweep TOTAL YEARS: 1

KEYWORDS:
liquid manure, tile drain,

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):
OMAF

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X | CONTRACT: | SOLICITED: | PROJECT NO: E564G
INTERNAL: | GRANT: X | UNSOLICITED: X | START DATE: 06/91

PROJECT TITLE:
Susceptibility of Groundwater to Contamination: A Case Study with Policy Implications

SHORT TITLE:
Susceptibility of Groundwatr top Contamination

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr. M. Sanderson
University of Waterloo

LIAISON OFFICER (name,branch,section,address,telephone no.):
G. Soo Chan
Water Resources Branch
4th Floor, 1 St. Clair Ave West
Toronto, Ontario M4V 1K6

(416) 323-4890

OBJECTIVE(S):
1.To conduct the necessary geological fieldwork and compile existing information to understand and describe the region's aquifers.
2.To use historical data and present mapping techniques to indicate the region's danger spots as far as groundwater contamination is concerned.
3.To answer the question "so what" by suggesting various alternatives in the management of groundwater quality in Ontario. It is necessary to use a multi-disciplinary approach in the research.

PROJECT DESCRIPTION:
The research study involves the following tasks: The geophysical logging of existing boreholes, selected drilling of deep holes, as well as the reconstruction of historical land uses, mapping of present land use. The determination of provincial context for groundwater management from examination of relevant legislation, MOE auditor general and other relevant reports, litigation records, financial statements and interviews with government officials and the private sector is then required.

The second phase requires the compilation and analysis of geological database from waterwell records and geotechnical reports will be completed. Infiltration levels from various land uses and the migration of associated contaminants will be estimated to establish the sources of recharge using a square grid. The role of green space and stormwater ponds will be examined. The final stage is the implementation of groundwater management in Waterloo region.

BUDGET AND RESOURCES:

YEAR: (* current)	1*	2	3	TOTAL
COST: ($000.s)	18.5			18.5

BUDGET SOURCE: Cleansweep TOTAL YEARS: 1.5

KEYWORDS:
groundwater, waterloo, hydrogeology, contamination, groundwater strategy

OUTPUT (papers, presentation, reports):
First progress report expected Dec. 1991, Final Report due: June 1993

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: E565G
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 08/91

PROJECT TITLE:
Development of a Surrogate Analyzer for Volatile Halogenated Organics in Water

SHORT TITLE:
Surrogate Analyzer/Volatile Halogenated Organics

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr. George Hayward
University of Guelph

LIAISON OFFICER (name,branch,section,address,telephone no.):
Mr. Bill Berg
Laboratory Services Branch
P.O. Box 213, 125 Resources Rd
Rexdale, Ontario M9W 5L1

(416) 235-5907

OBJECTIVE(S):
1. To develop and commercialize a family of water quality analyzers which provide surrogate measures of the concentration of volatile halogenated organic compounds in water.
2. To develop a prototype analyzer and to use it to establish its detection limits. The design refinements required to provide a commercial unit will also be evaluated.

PROJECT DESCRIPTION:
The research will commence with the construction of a prototype analyzer capable of detecting volatile halogenated organic compounds (VHO) in water. This analyzer will be based on a selective separation by a supported liquid membrane coupled to a selective detector (electron capture) to provide a surrogate measure of the VHO concentration in water. This prototype will be used to establish detection limits and data for further analyzer refinements. The project will eventually lead to the commercialization of a family of surrogate analyzers for VHO in water.

BUDGET AND RESOURCES:

YEAR: (* current)	1*	2	3	TOTAL
COST: ($000.s)	35.0			35.0

BUDGET SOURCE: Cleansweep TOTAL YEARS: 1

KEYWORDS:
surrogate analyzer, volatile, halogenated organics

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: E566G
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 05/91

PROJECT TITLE:
Development and Testing of a Body-Burden Based Model for Estimating the Toxicity of Mixtures of Organic Contaminants to Fish

SHORT TITLE:
Mixture Toxicity to Fish

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr. D. George Dixon
University of Waterloo

LIAISON OFFICER (name,branch,section,address,telephone no.):
Mr. Doug Spry
Water Resources Branch
4th Floor, 1 St. Clair Ave West
Toronto, Ontario M4V 1K6

(416) 323-4930

OBJECTIVE(S):
1. To provide the Ministry with a model which will allow a more comprehensive evaluation of the potential toxicity of complex mixtures of organic contaminants than is possible with current techniques. The first aim of the work is to generate the toxicity and kinetic parameters to be used in the model.
2. To develop kinetics based models to predict the outcome of exposure of fish to mixtures.
3. To undertake bioassays of the toxicant mixture, modelled in order to test the capabilities of our model.

PROJECT DESCRIPTION:
During the first year of this research study a first order kinetic model is developed to predict the cumulative toxicity of mixtures of organic contaminants to fish. The analysis of acute (lethal) toxicity bioassays with fathead minnow and a minimum of six organic chemicals is under taken in order to provide the toxicity and chemokinetic parameters necessary to undertake prediction with the model. The model will be validated experimentally; data generated in the first year is used to model (based on critical body concentrations of toxicants) the outcome of multiple-toxicant exposures. The final phase consists of acute toxicity tests with the mixtures in order to test the predictions.

BUDGET AND RESOURCES:

YEAR: (* current)	1	2*	3	TOTAL
COST: ($000.s)	79.3			79.3

BUDGET SOURCE: Cleansweep TOTAL YEARS: 1.5

KEYWORDS:
toxicity, fish

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: E567
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 05/91

PROJECT TITLE:
Relative Value of Fish Biomarkers, In Vitro Chemical Assay and Waterborne AOX Measurements for Evaluating Toxicity of Pulp Mill Effluents

SHORT TITLE:
Biomarkers and Pulp Mill Effluents

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr. G. Von der Kraak
University of Guelph

LIAISON OFFICER (name,branch,section,address,telephone no.):
Dr. Ian Smith
Water Resources Branch
6th Floor, 1 St. Clair Ave West
Toronto, Ontario M4V 1K6

(416) 323-4920

OBJECTIVE(S):
Liver MFO induction and serum steroids will be assessed for their use as biomarkers per effects of pulp mill effluent. Liver samples will be examined for their dioxin levels using a rat hepatoma cell line, and bile from these fish will be tested for mutagenicity in the AMES test.

PROJECT DESCRIPTION:
A variety of pulp mills (bleached and unbleached) will be sampled to determine if they impact on serum steroid levels and MFD in wild white suckers. The role of liver dioxin levels in these biomarkers will be assessed, as will the levels of mutagenicity, in evaluating the effectiveness of secondary treatment, and impact of bleached Kraft mills.

BUDGET AND RESOURCES:

YEAR: (* current)	1*	2	3	TOTAL
COST: ($000.s)	50.0			50.0

BUDGET SOURCE: Cleansweep TOTAL YEARS: 1.5

KEYWORDS:
pulp and paper, effluent, AOX, steroids, biomarkers

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):
University of Waterloo, Dept of Zoology

COMMENTS:
Reduced funding led to reduction in AOX measures

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

AIR RESOURCES BRANCH

TABLE OF CONTENTS

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL:	CONTRACT:	SOLICITED:	PROJECT NO: ARB-1
INTERNAL: X	GRANT:	UNSOLICITED:	START DATE: 03/82

PROJECT TITLE:
Method Development for Volatile Organics in Ambient Air

SHORT TITLE:
VOC Development

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Mr. P. Steer
Air Resources Branch

LIAISON OFFICER (name,branch,section,address,telephone no.):
N. Reid
Air Resources Branch
4th Floor, 880 Bay Street
Toronto, Ontario M5S 1Z8

(416) 326-1691

OBJECTIVE(S):
To develop a method for accurate sampling of volatile organic compounds an a routine basis.

PROJECT DESCRIPTION:
This is a joint ARB-LSB-Regional Offices project. The use of ambient cartridges and other sampling approaches is being evaluated by both laboratory and field testing, with a view to possible interferences, accuracy and precision.

BUDGET AND RESOURCES:

YEAR: (* current)	1	2	3	TOTAL
COST: ($000.s)				50.0

BUDGET SOURCE: Air Resources Branch TOTAL YEARS: 0.5

KEYWORDS:
volatile toxic organic compounds

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL:	CONTRACT:	SOLICITED:	PROJECT NO: ARB-2
INTERNAL: X	GRANT:	UNSOLICITED:	START DATE: 11/85

PROJECT TITLE:
Fluoride Criteria Studies

SHORT TITLE:
Fluoride Criteria

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Mr. R.D. Jones
Phytotoxicology Section

LIAISON OFFICER (name,branch,section,address,telephone no.):
D.S. Harper
Air Resources branch
4th Floor, 880 Bay Street
Toronto, Ontario M5S 1Z8

(416) 456-2505

OBJECTIVE(S):
To conduct a series of controlled environment exposures to evaluate the current (proposed) 24 gaseous fluoride criteria in air, with respect to injury to vegetation.

PROJECT DESCRIPTION:
Various species of plants with known sensitivity to gaseous fluoride are being exposed to fluoride concentrations at and above 1ppb (v/v) (0.86ug/1) for 24 hours. Injuries resulting from these exposures are rated and the plant tissue evaluated including: Manitoba maple, plum, gladiolus, apricot, tulip, wild grape and white pine. On completion, the validity of the 24 hour criteria (ippb) will be assessed.

BUDGET AND RESOURCES:

YEAR: (* current)	4	5	6	TOTAL
COST: ($000.s)				98.0

BUDGET SOURCE: Air Resources Branch TOTAL YEARS: 6

KEYWORDS:
fluoride, controlled exposure, vegetation

OUTPUT (papers, presentation, reports):
The results will be published in a Ministry report and possibly in a referred Journal

EXTERNAL PARTICIPATION (ministries, governments, agencies):
None

COMMENTS:
Report pending end of fiscal year

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL:	CONTRACT:	SOLICITED:	PROJECT NO: ARB-3
INTERNAL: X	GRANT:	UNSOLICITED:	START DATE: 06/88

PROJECT TITLE:
Eulerian Model Evaluation Field Study

SHORT TITLE:
Eulerian Model

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr. N. Reid
Air Resources Branch

LIAISON OFFICER (name,branch,section,address,telephone no.):
Dr. M. Lusis
Air Resources Branch
4th Floor, 880 Bay Street
Toronto, Ontario M5S 1Z8

(416) 326-1667

OBJECTIVE(S):
To collect special atmospheric chemistry measurements on acid-rain-related compounds, for evaluation of Eulerian long-range transport studies.

PROJECT DESCRIPTION:
Measurements of sulphur and nitrogen oxides in air and precipitation, and related compounds, are made in Dorset and a number of other sites.

BUDGET AND RESOURCES:

YEAR: (* current)	1	2	3*	TOTAL
COST: ($000.s)				220.0

BUDGET SOURCE: TOTAL YEARS: 3

KEYWORDS:
acid rain, atmospheric chemistry

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):
USEPA, EPRI, Environment Canada, Florida Acid Department Monitoring Program

COMMENTS:
Field measurements have been completed. Initial data sets have been delivered, and model evaluation is under way. A report is in preparation documenting the overall quality of the final data set.

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL:	CONTRACT:	SOLICITED:	PROJECT NO: ARB-4
INTERNAL: X	GRANT:	UNSOLICITED:	START DATE:

PROJECT TITLE:
TAGA Method Development

SHORT TITLE:
TAGA Method Development

PRINCIPAL INVESTIGATOR AND AFFILIATION:
G. DeBrou
Air Resources Branch

LIAISON OFFICER (name,branch,section,address,telephone no.):
M. Lusis
Air Resources Branch
4th Floor, 880 Bay Street
Toronto, Ontario M5S 1Z8

(416) 326-1667

OBJECTIVE(S):
To develop analytical methods to allow the TAGA to be applied to a range of chemical species.

PROJECT DESCRIPTION: This is an on-going program to expand the capability of the mobile TAGA system. It involves investigation of inlet conditions and ion chemistry, formation of a library and other techniques associated with CI/MS, MS/MS, etc.

BUDGET AND RESOURCES:

YEAR: (* current)	1	2	3	TOTAL
COST: ($000.s)	90.0			90.0

BUDGET SOURCE: Air Resources Branch TOTAL YEARS:

KEYWORDS:
TAGA, mobile machinery, toxic compounds, MS/MS

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:
This project has been on-going since the acquisition of the TAGA

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL:	CONTRACT:	SOLICITED:	PROJECT NO: ARB-5
INTERNAL: X	GRANT:	UNSOLICITED:	START DATE:

PROJECT TITLE:
Application of GC/MI/FTIR to Determination of Ambient PAH and Formaldehyde

SHORT TITLE:
FTIR Determination

PRINCIPAL INVESTIGATOR AND AFFILIATION:
R. Chapman
Air Resources Branch

LIAISON OFFICER (name,branch,section,address,telephone no.):
R. Bell
Air Resources Branch
4th Floor, 880 Bay Street
Toronto, Ontario M5S 1Z8

(416) 326-1670

OBJECTIVE(S):
To expand the capability of the Air Resources Branch in monitoring airborne pollutants.

PROJECT DESCRIPTION:
Methods development for the gas chromatography/matrix isolation/fourier transform infrared spectrometer system to provide a technique complementary to mass selective detection. Specific application to PAH and formaldehyde. Methods of sampling and sample delivery. Formation of compound library.

BUDGET AND RESOURCES:

YEAR: (* current)	1	2	3	TOTAL
COST: ($000.s)	25.0			25.0

BUDGET SOURCE: Air Resources Branch TOTAL YEARS: 1

KEYWORDS:
PAH, formaldehyde, FTIR

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:
This is an on-going program of method development.

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL:	CONTRACT:	SOLICITED:	PROJECT NO: ARB-6
INTERNAL: X	GRANT:	UNSOLICITED:	START DATE:

PROJECT TITLE:
Application of ADOM to the Transport and Deposition of Mercury

SHORT TITLE:
Mercury Modelling

PRINCIPAL INVESTIGATOR AND AFFILIATION:
C. Fung
Air Resources Branch

LIAISON OFFICER (name,branch,section,address,telephone no.):
P. Misra
Air Resources Branch
P.O. Box 213, 125 Resources Rd
Rexdale, Ontario M9W 5L1

(416) 235-5763

OBJECTIVE(S):
To predict the transport and deposition of mercury in eastern North America using ADOM.

PROJECT DESCRIPTION:
The ADOM model will be modified to allow its application to the emission, transport and deposition of mercury. Determination of the direct atmospheric input of mercury to water bodies, such as the great Lakes is of particular interest.

BUDGET AND RESOURCES:

YEAR: (* current)	1	2*	3	TOTAL
COST: ($000.s)	20.0			20.0

BUDGET SOURCE: Air Resources Branch TOTAL YEARS: 0.5

KEYWORDS:
model, mercury, ADOM

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

LABORATORY SERVICES BRANCH

TABLE OF CONTENTS

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL:	CONTRACT:	SOLICITED:	PROJECT NO: DWO-I-8850
INTERNAL: X	GRANT:	UNSOLICITED:	START DATE: 03/88

PROJECT TITLE:
Application of the Closed Loop Stripping (CLS) Techniques and GC/MS to Taste and Odour Problems

SHORT TITLE:
Taste and Odour Problems by CLS and GC/MS

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Vince Taguchi
Laboratory Services Board

LIAISON OFFICER (name,branch,section,address,telephone no.):
Don Robinson
Laboratory Services Branch
P.O. Box 213, 125 Resources Rd
Rexdale, Ontario M9W 5L1

(416) 235-5905

OBJECTIVE(S):
To provide an analytical protocol for the analysis of taste and odour causing compounds in potable water.

PROJECT DESCRIPTION:
A number of taster and odour causing compounds have been reported in the literature. Protocols are being developed for 2-methyl-isoborneol and geosmin. Selected ion monitoring techniques using EI and CI are being developed.

BUDGET AND RESOURCES:

YEAR: (* current)	1	2	3	TOTAL
COST: ($000.s)				

BUDGET SOURCE: TOTAL YEARS:

KEYWORDS:
closed loop stripping, taste and odour problems, geosmin

OUTPUT (papers, presentation, reports):
Technology Transfer Conference, 1988
Spectroscopy Society Conference, 1991

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL:	CONTRACT:	SOLICITED:	PROJECT NO: DWO-I-9002
INTERNAL: X	GRANT:	UNSOLICITED:	START DATE: 07/90

PROJECT TITLE:
Liquid Chromatography/Mass Spectrometry (LC-MS)

SHORT TITLE:
On-Line Liquid Chromatography/Mass Spectrometry (LC/MS)

PRINCIPAL INVESTIGATOR AND AFFILIATION:
V. Taguchi
Drinking Water Organics Section
Laboratory Services Branch

LIAISON OFFICER (name,branch,section,address,telephone no.):
V. Taguchi
Laboratory Services Branch
P.O. Box 213, 125 Resources Rd
Rexdale, Ontario M9W 5L1

(416) 235-5902

OBJECTIVE(S):
To provide on-line LC/MS analysis of extractable organics that are not detected by GC/MS.

PROJECT DESCRIPTION:
To acquire one LC/MS interface in each of the three years. To develop, using EI, CI, and FAB ionization techniques, on-line LC/MS analyses of selected extractable organics.

BUDGET AND RESOURCES:

YEAR: (* current)	1	2*	3	TOTAL
COST: ($000.s)	80.0	80.0	80.0	240.0

BUDGET SOURCE: LSB TOTAL YEARS: 3

KEYWORDS:
liquid chromatography/mass spectrometry (LC/MS)

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:
Optimization experiments not complete, Completion date is March 1, 1993.

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL:	CONTRACT: X	SOLICITED:	PROJECT NO: ITC-E-8802
INTERNAL: X	GRANT:	UNSOLICITED:	START DATE: 08/88

PROJECT TITLE:
Source Identification of Borne Particulates of Environmental Concern Using Surface and Microchemical Techniques

SHORT TITLE:
Source Identification of Air Particulates

PRINCIPAL INVESTIGATOR AND AFFILIATION:
R.R. Martin
University of Western Ontario

LIAISON OFFICER (name,branch,section,address,telephone no.):
J. Hipfner/R. Moody
Laboratory Services Branch
P.O. Box 213, 125 Resources Rd
Rexdale, Ontario M9W 5L1

(416) 235-5856

OBJECTIVE(S):
To develop a series of instrumental tests which may be used to identify specific sources of airborne particulates. The environmental toxicity will also be assessed.

PROJECT DESCRIPTION:
This project will provide MOE with an expanded capability for identification of air particulates relating to sources; has application toward complaint investigations and long range air transport of particulates. University of Western Ontario will be utilizing the resources of the Surface Science Centre which received funding recently by the Ontario Government as a Centre of Excellence. The work will be done by an MSc student who will work closely with Laboratory Services Branch staff.

BUDGET AND RESOURCES:

YEAR: (* current)	1	2	3	TOTAL
COST: ($000.s)	8.6	42.9	37.4	88.9

BUDGET SOURCE: LSB TOTAL YEARS: 3

KEYWORDS:
airborne particulates, characterization

OUTPUT (papers, presentation, reports):
1. "The Use of Surface Science Techniques in the Characterization of Inhaleable Air Particulates", R. Martin, J. Hipfner and R. Moody, Presented at CIC Conference, Victoria, B.C., June 1989.
2. "Catalytic Properties of Air Particulates", J. Hiphner, R. Martin. Presented at the Canadian Chemical Congress, Halifax, N.S. July 1990.

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS: This project is part of the Lab/University Joint Research Venture Program. Final Report Pending.

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL:	CONTRACT:	SOLICITED:	PROJECT NO: ITC-I 8901
INTERNAL: X	GRANT:	UNSOLICITED:	START DATE: 07/89

PROJECT TITLE:
The Application of ICP/MS for the Analysis of Metals in Surface Waters

SHORT TITLE:
ICP/MS Surface Waters

PRINCIPAL INVESTIGATOR AND AFFILIATION:
M. Powell/E. Quan
Inorganic Trace Contaminants Section
Laboratory Services Branch

LIAISON OFFICER (name,branch,section,address,telephone no.):
M. Powell/E. Quan
Laboratory Services Branch
P.O. Box 213, 125 Resources Rd
Rexdale, Ontario M9W 5L1

(416) 235-5834

OBJECTIVE(S):
To assess the feasibility of using ICP/MS for the analysis of surface water samples on a routine basis.

PROJECT DESCRIPTION:
Data from previous analysis of routine surface water samples submitted to MOE will be summarized. Experiments will be carried out to determine the limitations of ICP/MS for these samples. A tentative methods using matrix matching, internal standards, and appropriate instrument settings will be devised and tested. Sample screening and data routing procedures will be implemented as necessary.

BUDGET AND RESOURCES:

YEAR: (* current)	1	2	3*	TOTAL
COST: ($000.s)	30.0	30.0		60.0

BUDGET SOURCE: LSB TOTAL YEARS: 3

KEYWORDS:
ICP/MS, water analysis

OUTPUT (papers, presentation, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:
Completion date August 1992

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL:	CONTRACT:	SOLICITED:	PROJECT NO: TO-I 8903
INTERNAL: X	GRANT:	UNSOLICITED:	START DATE: 05/89

PROJECT TITLE:
Development of Method for the Analysis of Base/Neutral and Phenolic Compounds in (MISA Test Groups 19, 20) Municipal Sewage Sludge

SHORT TITLE:
Method - Sludge Analysis (Base/Neutral and Phenolics)

PRINCIPAL INVESTIGATOR AND AFFILIATION:
R. Lega
Trace Organics Section
laboratory Services Branch

LIAISON OFFICER (name,branch,section,address,telephone no.):
Laboratory Services Branch
P.O. Box 213, 125 Resources Rd
Rexdale, Ontario M9W 5L1

OBJECTIVE(S):
To develop method for the analysis of base/neutral and phenolic compounds in municipal sludge.

PROJECT DESCRIPTION:
The project involves the following: 1) Evaluate various techniques, e.g. NP, RP, GPC for the clean-up of sludge extracts. Select an appropriate technique and establish elution pattern for compounds which are under investigation; 2) Establish extraction procedure for municipal sludges with varying solid contents; 3) Apply the existing in-situ acetylation procedure if required to various sludge extract; 4) Establish recovery, MDLs and QC data as required by the Laboratory Services Branch/MOE; and 5) Write a method report.

BUDGET AND RESOURCES:

YEAR: (* current)	1	2	3	TOTAL
COST: ($000.s)	95.0			95.0

BUDGET SOURCE: LSB TOTAL YEARS: 1

KEYWORDS:
base, neutral and phenolic organics, analysis, municipal sludge

OUTPUT (papers, presentation, reports):
The project is expected to be complete March 1992

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL:	CONTRACT:	SOLICITED:	PROJECT NO: WQ-I-9003
INTERNAL: X	GRANT:	UNSOLICITED:	START DATE: 01/90

PROJECT TITLE:
Development of an Image Analyzer for the Enumeration of Bacterial Colonies on Membrane Filters

SHORT TITLE:
Image Analyzer Study

PRINCIPAL INVESTIGATOR AND AFFILIATION:
M. Young/G. Horsnell
Water Quality Section
Laboratory Services Branch

LIAISON OFFICER (name,branch,section,address,telephone no.):
M. Young/G. Horsnell
Laboratory Services Branch
P.O. Box 213, 125 Resources Rd
Rexdale, Ontario M9W 5L1

(416) 235-5866

OBJECTIVE(S):
To develop an automated system for enumeration of bacterial colonies on membrane filters with Direct Computer (LIS) Input.

PROJECT DESCRIPTION:
Initially work will concentrate on the Fecal Coliform parameter. Counts will be made of routine FC plates both by technicians and using the Image Analyzer. Results will be used to refine colour ranges which are acceptable and the necessary physical measurements required to accurately identify both single and multiple target colonies.

BUDGET AND RESOURCES:

YEAR: (* current)	1	2 *	3	TOTAL
COST: (000's):	60.0	23.0		83.0

BUDGET SOURCE: LSB TOTAL YEARS: 2

KEYWORDS:
image analysis, enumeration, bacterial colonies, automation, DCI

OUTPUT (papers, presentation, reports):
Nikon Canada and Videtics International

COMMENTS:
This project would increase quality and efficiency of counting procedures and would be the first step in untomating the Bacti laboratory.

EXTERNAL PARTICIPATION (ministries, governments, agencies):

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

WASTE MANAGEMENT BRANCH

TABLE OF CONTENTS

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X CONTRACT: X SOLICITED: X PROJECT NO: POA94386
INTERNAL: GRANT: UNSOLICITED: START DATE: 08/86

PROJECT TITLE:
Development of a Laboratory Qualification Standard (Code) for Laboratories Analyzing Industrial Wastes

SHORT TITLE:
Laboratory Qualification Code

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Mr. Jim Dixon
Canadian Standards Assoc.

LIAISON OFFICER (name,branch,section,address,telephone no.):
Steve Radcliffe
Waste Management Branch

(416) 323-5188

OBJECTIVE(S):
To develop a qualification standard for laboratories analyzing industrial wastes required by Ontario Regulation 309. The standard is to be developed by a consensus approach and must be capable of being used with any subsequent certification programs that the Ministry may wish to proceed with a future date.

PROJECT DESCRIPTION:
The qualification standard should be developed by a consultative process involving regulatory agencies, industry, testing agencies an other interested parties. It will need to address items such as minimum staff requirements, administrative and technical requirements of laboratories performing tests on industrial wastes.

BUDGET AND RESOURCES:

YEAR: (* current)	4	5	6*	TOTAL
COST: ($000.s)			10.0	50.00

BUDGET SOURCE: WMB TOTAL YEARS: 6

KEYWORDS:
laboratory, qualification code, industrial waste

OUTPUT (papers, presentation, reports):
CSA Standard Z201 to be released

EXTERNAL PARTICIPATION (ministries, governments, agencies):
Technical committee which is developing the code by consensus, including representatives from regulatory authorities, industry, academia, testing agencies and other interested parties.

COMMENTS:
In progress

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

WATER RESOURCES BRANCH

TABLE OF CONTENTS

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL:	CONTRACT:	SOLICITED:	PROJECT NO: WRB
INTERNAL: X	GRANT:	UNSOLICITED:	START DATE: 1987

PROJECT TITLE:
Control of Blue Green Algae Problems in Southern Ontario Lakes and Reservoirs

SHORT TITLE:
Blue-Green Algae Control

PRINCIPAL INVESTIGATOR AND AFFILIATION:
K. Nicholls/H. Vandermeulen
Water Resources Branch

LIAISON OFFICER (name,branch,section,address,telephone no.):
K. Nicholls
Water Resources Branch
P.O. Box 213, 125 Resources Rd
Rexdale, Ontario M9W 5L1

(416) 235-5810

OBJECTIVE(S):
To Evaluate methods of eliminating blue-green algal blooms using biomanipulation, physical and chemical treatment of whole lakes and reservoirs.

PROJECT DESCRIPTION:
A variety of lake management techniques are being evaluated for their ability to control blue-green algae growth in several lakes and reservoirs in southern Ontario. These include nitrate, fertilization, calcium carbonate treatment, aeration/destratification and hypolimnetic aeration.

BUDGET AND RESOURCES:

YEAR: (* current)	4	5*	6	TOTAL
COST: ($000.s)	110.0	110.0		590.0

BUDGET SOURCE: WRB TOTAL YEARS: 6.5

KEYWORDS:
blue-green algae, lake treatment

OUTPUT (papers, presentation, reports):
Reports, seminars, conference papers, journals

EXTERNAL PARTICIPATION (ministries, governments, agencies):
Ministry of Natural Resources Conservation Authorities

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

REGIONAL PROJECTS

TABLE OF CONTENTS

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT: X	SOLICITED: X	PROJECT NO: A14292
INTERNAL:	GRANT:	UNSOLICITED:	START DATE: 11/89

PROJECT TITLE:
Aquatic Habitat Geographical Information System and its Application to Classification of Aquatic Vegetation and Piscivave Habitat in the Bay of Quinte - Phase I

SHORT TITLE:
GIS - Bay of Quinte Aquatic Habitat (Phase I)

PRINCIPAL INVESTIGATOR AND AFFILIATION:
K. Loftus
LGL Limited

LIAISON OFFICER (name,branch,section,address,telephone no.):
F. Stride
Southeastern Region
Box 820, 133 Dalton Ave.
Kingston, Ontario K7L 4X6

(613) 549-4000

OBJECTIVE(S):
To produce GIS maps of the Bay of Quinte relevant to aquatic vegetation, pike habitat and shoreline uses.
To produce a GIS model of factors (including man induced stresses and remedial actions) affecting aquatic vegetation and to relate that information to preferred pike habitat.

PROJECT DESCRIPTION:
Develop is quickly altering the Bay of Quinte shoreline. At the same time, pollution has affected adversely water quality conditions. Remedial actions to control both these concerns will have an impact on aquatic vegetation and, in the long term, the structure of the fish community. A GIS will be used to illustrate - via maps - the estimated changes. The GIS employee natural factors (e.g. wind, substrate, fetch, etc.) and man-induced factors (e.g. shoreline alterations, point source discharges, etc.).

BUDGET AND RESOURCES:

YEAR: (* current)	1	2*	3	TOTAL
COST: ($000.s)	20.0	34.0		54.0

BUDGET SOURCE: Bay of Quinte Remedial Action Plan TOTAL YEARS: 1.25

KEYWORDS:
GIS, aquatic vegetation, pike habitat, Bay of Quinte

OUTPUT (papers, presentation, reports):
GIS report model, GIS maps, Workshop/Presentation to Quinte municipal planners and developers.

EXTERNAL PARTICIPATION (ministries, governments, agencies):
MNR, DFO

COMMENTS:
In progress, to be completed in October 1990.

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RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT: X	SOLICITED: X	PROJECT NO: SER
INTERNAL:	GRANT:	UNSOLICITED:	START DATE: 09/90

PROJECT TITLE:
Fate and Transport of Toxic Contaminants in the Bay of Quinte - Phase II

SHORT TITLE:
Contaminant Fate - Quinte

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Don McKay
University of Toronto

LIAISON OFFICER (name,branch,section,address,telephone no.):
D. Poulton
Water Resources Branch
4th Floor, 1 St. Clair Ave West
Toronto, Ontario M4V 1K6

(416) 323-4954

F. Stride
Southeastern Region
Box 820, 133 Dalton Ave.
Kingston, Ontario K7L 4X6

(613) 549-4000

OBJECTIVE(S):
To model the fate of 10 additional contaminants in the Bay of Quinte employing the fugacity model developed in Phase I of this study. (NOTE: Seasonality is not employed.)

PROJECT DESCRIPTION:
Contaminants exceed Provincial guidelines for water, sediment (open water disposal of dredgate) and fish consumption. The contaminants of concern are Hg, Zn, Cu, PCB, Mivex, As, PCP and dioxins. As well, some agricultural pesticides are present in Quinte sediments. In 1989, the Quinte RAP team had a contractor develop a fate-transport model for Arsenic, Pentachlorophenol and PCB. In the case of As and PCP, the model was calibrated successfully with observed data. In 1990, the Quinte RAP team will expand the number of contaminants modelled.

BUDGET AND RESOURCES:

YEAR: (* current)	1	2*	3	TOTAL
COST: ($000.s)	30.0	30.0		60.0

BUDGET SOURCE: Bay of Quinte Remedial Action Plan TOTAL YEARS: 1.5

KEYWORDS:
toxic contaminants, model, Bay of Quinte, fugacity, fate and transport

OUTPUT (papers, presentation, reports):
"Modelled Fate of Contaminants" report

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:
The contaminants to be modelled will be those (1) found in the bay, or (2) where sufficient data exists.

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

ONTARIO PESTICIDES ADVISORY COMMITTEE PROJECTS

TABLE OF CONTENTS

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: OPAC 90-01
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 04/90

PROJECT TITLE:
Development of Disparvirus (gypsy moth nuclear polyhedrosis virus) as a microbial insecticide for use in Canada

SHORT TITLE:
Disparvirus as an insecticide in Canada

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr. J.C. Cunningham and W.J. Kaupp
Sault College of Applied Arts & Tech

LIAISON OFFICER (name,branch,section,address,telephone no.):
Dr. R.C. Harris
OPAC
135 St. Clair Ave. West
5th Floor
Toronto, Ontario M4V 1P5

(416) 323-4447

OBJECTIVE(S):
To conduct follow-up surveys on plots sprayed in 1988 and 1989 and untreated check plots and determine the long-term effect of Disparvirus treatments. To study spread of Disparvirus from a small, discreet site. To study leaf surface contamination with nuclear polyhedrosis virus as an early indicator of virus epizootics in gypsy moth populations.

PROJECT DESCRIPTION:
The aim is to develop gypsy moth nuclear polyhedrosis virus (Disparvirus) as an effective and economical alternative to Bacillus thuringiensis for operational control of gypsy moth in Ontario. Parameters such as dosage, timing of applications, emitted volumes and tank mixes will be studied. Treated and check plots will be monitored for several years to determine long-term impacts of Disparvirus. Epizootiological studies will elucidate mechanisms of horizontal and vertical transmission and it is hoped that a survey of the amount of virus on leaf surfaces early in the season can be used as an indicator of an impending virus epizootic.

BUDGET AND RESOURCES:

YEAR: (* current)	1*	2	3	TOTAL
COST: ($000.s)	17.7			17.7

BUDGET SOURCE: OPAC TOTAL YEARS: 0.6

KEYWORDS:
nuclear polyhedrosis virus, gypsy moth, biocontrol

OUTPUT (papers, presentation, reports):
OPAC Seminar 1991

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: OPAC 90-02
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 04/90

PROJECT TITLE:
Sustainable Alternatives to Fumigation for the Control of Root Lesion Nematodes

SHORT TITLE:
Alternatives to Fumigation/Root Lesion Nematodes

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr. J.E. Brandle
Delhi Res. Sta.

LIAISON OFFICER (name,branch,section,address,telephone no.):
Dr. R.C. Harris
OPAC
5th Floor, 135 St. Clair Ave. West
Toronto, Ontario M4V 1P5

(416) 323-4447

OBJECTIVE(S):
The first is to assess the nematicidal activity of isothiocyanates derived from rape leaves. The second is to establish a crop rotation, which will allow evaluation of rape as a viable alternative to soil fumigation. The ultimate goal is to provide farmers with a practical alternative that will allow chemical nematicides to be removed from the current cropping system.

PROJECT DESCRIPTION:
Large amounts of soil fumigants are used to control root lesion nematodes in the coarse textured soils of southwestern Ontario. Rape leaves, stems and roots contain compounds known as glucosinolates, which are hydrolyzed to isothiocyanates when tissues are damaged. These plant derived isothiocyanate, which is a component of some soil fumigants used for nematode control. The purpose of this research is first to determine if the isothiocyanates derived from rape have nematicidal activity and secondly to evaluate rape as a rotational crop for use in suppression of nematode populations.

BUDGET AND RESOURCES:

YEAR: (* current)	1*	2	3	TOTAL
COST: ($000.s)	7.8			7.8

BUDGET SOURCE: OPAC TOTAL YEARS: 0.3

KEYWORDS:
Brassica napus, nemoticidal activity of leaf derivatives, isotiocyanate soil fumigants

OUTPUT (papers, presentation, reports):
OPAC Seminar 1991

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: OPAC 90-03
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 03/90

PROJECT TITLE:
Ecotoxicological Impact of Agricultural Runoff in Streams: The Effects of Atrazine, Metolachlor and Nutrient Interactions on Primary Productivity of Attached Algae

SHORT TITLE:
Ecotoxicological Impacts of Agricultural Runoff

PRINCIPAL INVESTIGATOR AND AFFILIATION:
K.E. Day
Rivers Research Branch National Water Research Institute

LIAISON OFFICER (name,branch,section,address,telephone no.):
Dr. R.C. Harris
OPAC
5th Floor, 135 St. Clair Ave. West
Toronto, Ontario M4V 1P5

(416) 323-4447

OBJECTIVE(S):
To develop methodology to determine the effects of agricultural chemicals, particularly atrazine and metolachlor on attached algae found growing in aquatic lotic ecosystems next to agricultural land. To determine the interactive effects of atrazine and metolachlor in combination with other agricultural contaminants such as NO3, -NO2, and phosphorus.

PROJECT DESCRIPTION:
The ecotoxicological effects of two herbicides, atrazine and metolachlor, on the growth and productivity of attached algal communities (periphyton) will be determined. In the laboratory, the effects of short and long-term exposure (hours to weeks) to combinations of herbicides and different levels of nutrients will be studied under controlled conditions of light and temperature. The effects of short-term, pulsed doses of each herbicide on the photosynthetic activity of natural periphyto will also be determined in a portable streamban incubator.

BUDGET AND RESOURCES:

YEAR: (* current)	1	2*	3	TOTAL
COST: ($000.s)	16.0			16.0

BUDGET SOURCE: OPAC TOTAL YEARS: 1

KEYWORDS:
pesticide runoff, impact on attached algae

OUTPUT (papers, presentation, reports):
OPAC Seminar 1991

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: OPAC 90-04
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 04/90

PROJECT TITLE:
Reducing the Rates of Glyphosate to Control Broad-Leaved Trees in Conifer Populations

SHORT TITLE:
Broad-Leaved Trees/Glyphosate Rates

PRINCIPAL INVESTIGATOR AND AFFILIATION:
G. Hofstra
University of Guelph

LIAISON OFFICER (name,branch,section,address,telephone no.):
Dr. C.R. Harris
OPAC
5th Floor, 135 St. Clair Ave West.
Toronto, Ontario M4V 1P5

(416) 323-4447

OBJECTIVE(S):
To determine the sensitivity of various broad-leaved trees to low rates of glyphosate at different times during the growing season. To determine the effect of low levels of glyphosate on white spruce and jack pine at different times during the growing season. To establish a strategy for conifer release using the levels of glyphosate. To continue the measurements in the field of the trees sprayed in 1987 and 1988.

PROJECT DESCRIPTION:
To reduce the rate of glyphosate needed to control broad-leaved species in conifer plantations, and to increase the time period during which spraying can be cone. Treatments in the field indicate that injury continues to develop over at least a 2 year period, and the ability of treat trees to compete and survive appears to diminish. If immediate kill of undesirable woody vegetation is not needed, lower field rates could suffice. Since applications at 25% RFR (Registered Federal Rate) showed quite significant declines in vigour and survival a reduction by 50% of the currently accepted rates could suffice for the control of deciduous weed species in conifer plantations.

BUDGET AND RESOURCES:

YEAR: (* current)	1	2*	3	TOTAL
COST: ($000.s)	20.1			20.1

BUDGET SOURCE: OPAC TOTAL YEARS: 1

KEYWORDS:
glyphosate, conifer plantations, reduced rates

OUTPUT (papers, presentation, reports):
OPAC Seminar 1991

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: OPAC 90-05
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 04/90

PROJECT TITLE:
Effectiveness of the Granulosis Virus in Management of the Codling Moth in Apple Orchards and its Environmental Impact

SHORT TITLE:
Granulosis Virus and Apple Orchards

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr. R. Jaques
Agricultural Canada

LIAISON OFFICER (name,branch,section,address,telephone no.):
Dr. C.R. Harris
OPAC
5th Floor, 135 St. Clair Ave West.
Toronto, Ontario M4V 1P5

(416) 323-4447

OBJECTIVE(S):
To determine the effectiveness of the granulosis virus of the codling moth in a management system for apple orchards by laboratory bioassys, by a plot trial in a research orchard, in a grower's orchard under commercial conditions and for pear orchards in a small-scale test on pears. To determine the impact of the virus on nontarget arthropods, particularly species that are parasitic or predaceous. To evaluate persistence of the virus and identify materials to protect virus against inactivation by sunlight. To assemble data to support application for registration of the virus for use in Canada.

PROJECT DESCRIPTION:
This study is to assess effectiveness of granulosis virus for control of the codling moth and the impact of the virus on nontarget arthropods by small-plot trials in research orchards and by a small-plot trial in a grower's orchard. Persistence of the virus will be assessed by field and laboratory techniques. These studies are to support application for registration of the virus for use as an alternative to chemical insecticides.

BUDGET AND RESOURCES:

YEAR: (* current)	1	2*	3	TOTAL
COST: ($000.s)	23.5			23.5

BUDGET SOURCE: OPAC TOTAL YEARS: 1

KEYWORDS:
granulosis virus, codling moth nontarget impact

OUTPUT (papers, presentation, reports):
OPAC Seminar 1991

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: OPAC 90-06
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 04/90

PROJECT TITLE:
Integration of Biological Control of Cucumber Powdery Mildew into the Greenhouse Pest Management Program

SHORT TITLE:
Biological Control of Cucumber Mildew

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr. W.R. Jarvis
Agriculture Canada

LIAISON OFFICER (name,branch,section,address,telephone no.):
Dr. C.R. Harris
OPAC
5th Floor, 135 St. Clair Ave West.
Toronto, Ontario M4V 1P5

(416) 323-4447

OBJECTIVE(S):
To determine the compatibility of Sprothrix rugulosus and S. flocculosus with registered and candidate pesticides in cucumber production. To determine compatibility with insect rpedators and parasites Amblyseius cucumeris, Aphidoletes aphidiomyza, Encarsia formosa and Hypoaspis sp. (potential control of fungus gnats and thrips). To determine compatibility with entomophathogens Verticillium lecanii, Aschersonia aleyrodis, and Bacillus thuringiensis.

PROJECT DESCRIPTION:
A very effective biological control for cucumber powdery mildew has been developed. Two species of Stephanoascus which are yeastlike fungi, control this and other powdery mildew diseases (eg. or roses and begonia) at an optimum temperature of 26 degrees Celcius and at relative humidities greater than 80%. These conditions are provided by microfine fogging systems now commong in many Ontario greenhouses. However, there is no information on the compatibility of this biological control with chemical pesticide and with insect predators, parasites, and entomophathogens.

BUDGET AND RESOURCES:

YEAR: (* current)	1	2*	3	TOTAL
COST: ($000.s)	8.5			8.5

BUDGET SOURCE: OPAC TOTAL YEARS: 0.5

KEYWORDS:
cucumber powdery mildew, stephanoascus

OUTPUT (papers, presentation, reports):
OPAC Seminar 1991

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: OPAC 90-07
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 04/90

PROJECT TITLE:
Impact of Algal Fibrils on Bioavailability of Pesticides to Non-Target Aquatic Organisms

SHORT TITLE:
Algal Fibrils/Bioavailability of Pesticides

PRINCIPAL INVESTIGATOR AND AFFILIATION:
N.K. Kaushik
University of Guelph

LIAISON OFFICER (name,branch,section,address,telephone no.):
Dr. C.R. Harris
OPAC
5th Floor, 135 St. Clair Ave West.
Toronto, Ontario M4V 1P5

(416) 323-4447

OBJECTIVE(S):
To investigate the role of algal fibrils in bioavailability of pesticides to nontarget organisms in water. To investigate bioavailability of fenvalerate to Daphnia magna and of atrazine to Anagaena cylindrica and Selenastrum capricornutum in the presence and absence of fibrils. A comparison with suspended sediments will indicate the relative importance of adsorption of pesticides by fibrils in a quatic environment. Manipulating various parameters such as fibril dose, physical contact and contact time with fibrils and resulting effects on toxicity will also be investigated. Also, the production and manipulation of algae to produce fibrils will be pursued.

PROJECT DESCRIPTION:
Algal fibrils are an important component of dissolved organic matter which have a role in the fate and bioavailability of contaminants in aquatic systems. Fibrils appeared to reduce the toxicity of fenvalerate to Daphnia magna. An adhesion reaction also occurred which impaired the mobility of D. magna. An adhesion reaction also occurred which impaired the mobility of D. magna. We wich to further investigate the interaction of fenvalerate to D. magna and atrazine toxicity to Anabaena cylindrica and Selenastrum capricornutum in the presence and absence of fibrils.

BUDGET AND RESOURCES:

YEAR: (* current)	1	2*	3	TOTAL
COST: ($000.s)	15.0			15.0

BUDGET SOURCE: OPAC TOTAL YEARS: 0.5

KEYWORDS:
algal fibrils, aquatic organisms

OUTPUT (papers, presentation, reports):
OPAC Seminar 1991

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: OPAC 90-08
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 04/90

PROJECT TITLE:
Evaluation of Alternate Methods of Pest Control for Home Garden

SHORT TITLE:
Home Garden Pest Control Alternatives

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr. D.G.R. McLeod
University of Western Ontario

LIAISON OFFICER (name,branch,section,address,telephone no.):
Dr. C.R. Harris
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OBJECTIVE(S):
To test alternative means of reduction of pest damage in the home garden. To study the effect of different brands of floating row covers on growth of radish, onion and pepper. To examine the possibility of using Agronet floating row cover in the commercial production of organic peppers. The research will be summarized and a popular article.

PROJECT DESCRIPTION:
To evaluate alternate means of pest control in home gardens and small truck farms. Mass trapping and companion planting will be tested for effect on preventing damage to radish, onion and cabbage. Fabric row covers will be tested for their effect on growth of radish, onion and peppers and their use and acceptability by truck crop farmers.

BUDGET AND RESOURCES:

YEAR: (* current)	1	2*	3	TOTAL
COST: ($000.s)	18.0			18.0

BUDGET SOURCE: OPAC TOTAL YEARS: 0.7

KEYWORDS:
biocontrol, home garden, root maggots, polyester row covers, Aleochara bilineata

OUTPUT (papers, presentation, reports):
OPAC Seminar 1991

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: OPAC 90-09
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 04/90

PROJECT TITLE:
Hyperparasitism and Strategies for the Biological Control of Gypsy Moth in Ontario

SHORT TITLE:
Gypsy Moth Control in Ontario

PRINCIPAL INVESTIGATOR AND AFFILIATION:
V.G. Nealis
Forestry Canada

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OBJECTIVE(S):
To estimate the impact of hyperparasitism on populations of parasitoids attacking gypsy moth in Ontario. To examine the relative vulnerability of new, potential agents to hyperparasitims. To make recommendations concerning the feasibility of particular biocontrol strategies using gypsy moth parasitoids in Ontario.

PROJECT DESCRIPTION:
Both inundative and inoculative releases of parasitoids are established biocontrol strategies for gypsy moth in North America. Surveys of gypsy moth parasitoids already established in Ontario indicate that hyperparasitism may severly limit the effectiveness of releases of some parasitoids. This project will developed a method for estimating the impact of hyperparasitism on gypsy moth parasitoids and will examine through controlled experiments, the relative vulnerability of potential biocontrol candidates to hyperparasitism in Ontario. The results will assist pest managers in developing a decision-support system for the selection of biocontrol agents and strategies for their use in Ontario.

BUDGET AND RESOURCES:

YEAR: (* current)	1	2*	3	TOTAL
COST: ($000.s)	13.8			13.8

BUDGET SOURCE: OPAC TOTAL YEARS: 0.7

KEYWORDS:
hyperparasitism, gypsy moth, biocontrol agents/strategies

OUTPUT (papers, presentation, reports):
OPAC Seminar 1991

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: OPAC 90-10
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 04/90

PROJECT TITLE:
Organic and Modified Programs for the Control of Apple Scab.

SHORT TITLE:
Apple Scab. Control

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr. J. Northover
Agriculture Canada

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OBJECTIVE(S):
To determine the rate of dissipation and terminal harvest residues on apple fruits sprayed with mancozeb 45, 60 and 75 days prior to harvest. To determine the relative efficacies of five readily available begetable oils applied to potted McIntosh and McIntosh seedling plants as oil-in-water emulsions for protections against, or inactivation of apple scab.

PROJECT DESCRIPTION:
The project will research more acceptable and sustainable means of controlling apple scab (Venturia inaequalis). One approach will examine the rate of dissipation and the terminal harvest residues of mancozeb on apples sprayed with longer preharvest intervals than the current 30 days. The other approach will evaluate the efficacy of an "organic" method involving the application of emulsified vegetable oils in water.

BUDGET AND RESOURCES:

YEAR: (* current)	1	2*	3	TOTAL
COST: ($000.s)	10.0			10.0

BUDGET SOURCE: OPAC TOTAL YEARS: 0.4

KEYWORDS:
scab/(Venturia inaequalis), mancozeb residue decline, emulsified vegetable oil efficacy

OUTPUT (papers, presentation, reports):
OPAC Seminar 1991

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: OPAC 90-11
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 04/90

PROJECT TITLE:
New Technology for Insecticide Placement to Control Soil Insects in Row Crops at Cultivation Time

SHORT TITLE:
New Technology for Insecticide Placement

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Mr. A.W. Schaafsma
Ridgetown College of Agricultural Technology

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OBJECTIVE(S):
To design, develop and modify injection applicators to achieve optimum insecticide placement for corn rootworm control injection when corn rootworm larvae are active. To test prototype injection equipment for commercial utility in rootworm insecticide applications.

PROJECT DESCRIPTION:
Focuses on developing a modified approach to corn rootworm control to reduce the amount of insecticide applied to Ontario soils by order of magnitude of about 75%. Developing new insecticide application technology for soil insect control has been identified as a research priority by the Field Crops Recommendation Subcommittee as first priority for long term funding. The 1989 grant supported construction and testing (small plot) of a manual injector. The 1990 work is to design and construct a 2 row slot injector for larger scale field trials.

BUDGET AND RESOURCES:

YEAR: (* current)	1	2*	3	TOTAL
COST: ($000.s)	6.0			6.0

BUDGET SOURCE: OPAC TOTAL YEARS: 0.4

KEYWORDS:
western corn rootworm, layby soil injection equipment design

OUTPUT (papers, presentation, reports):
OPAC Seminar 1991

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: OPAC 90-12
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 04/90

PROJECT TITLE:
Management of the Strawberry Root Weevil in Ornamental Tree Nursery Production using Entomophagous Nematodes

SHORT TITLE:
Strawberry Root Weevil Management

PRINCIPAL INVESTIGATOR AND AFFILIATION:
S.M. Smith
University of Toronto

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OBJECTIVE(S):
To develop a pest management program for the strawberry root weevil on ornamental spruce nurseries in southern Ontario. This will achieved by determining the life-cycle and biology of the weevil in southern Ontario; by developing a non-destructive sampling technique for predicting weevil infestation; and by selecting and releasing entomophagous nematodes for biological control of the weevil under laboratory and field conditions.

PROJECT DESCRIPTION:
The strawberry root weevil is a relatively recent pest in Ontario tree nurseries, limited the production of ornamental conifer stock. No management guidelines are currently available for control of this important pest. The proposed research will develop a pest management program for strawberry root weevil by addressing 3 objectives listed above. Adult weevils will be released into caged trees at the field site and the trees sampled bi-monthly from May 1990 to April 1991 to measure weevil development. A number of different non-destructive sampling techniques will be investigated for predicting weefil infestation. Entomophagous nematodes will be released against the weevil in laboratory and field trials using surface and injection techniques.

BUDGET AND RESOURCES:

YEAR: (* current)	1	2*	3	TOTAL
COST: ($000.s)	18.0			18.0

BUDGET SOURCE: OPAC TOTAL YEARS: 0.8

KEYWORDS:
strawberry root weevil biology, biocontrol, entomophagous nematodes

OUTPUT (papers, presentation, reports):
OPAC Seminar 1991

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: OPAC 90-13
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 04/90

PROJECT TITLE:
Integrated Weed Management Systems with Onions on Muck Soils

SHORT TITLE:
Weed Management and Muck Soils

PRINCIPAL INVESTIGATOR AND AFFILIATION:
V. Souza Machada
University of Guelph

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OBJECTIVE(S):
To evaluate the effect of cover crops on the weed pressure during the subsequent crops of onions on muck soils. To establish the "critical period" of broadleaf and grass weed interference with onions on muck soils. Field responses of osmoconditioned onions in relation to early seeding establishment and development. Interaction of barley wind abatement plantings as rows or broadcast, with onions and broadleaf weeds.

PROJECT DESCRIPTION:
The objectives of the program are to manipulate interspecific crop/weed competition, involving the introduction of "protector" species that would be used as a winter cover species and a spring abatement species, so as to reduce weed interference with the "protected" crop as well as minimize wind erosion. The "protected" crop would also be primed with polyethylene glycol prior to field planting, so as to enhance seedling vigour at low germination/emergence soil temperatures and be therefore more effective in weed competition. This strategy would hopefully maintain crop yields, lower the volume of herbicides used in the environment and prevent the loss of valuable horticultural topsoil from farmlands.

BUDGET AND RESOURCES:

YEAR: (* current)	1	2*	3	TOTAL
COST: ($000.s)	16.0			16.0

BUDGET SOURCE: OPAC TOTAL YEARS: 1

KEYWORDS:
crop/weed competition, "protector species", polyethylene glycol

OUTPUT (papers, presentation, reports):
OPAC Seminar 1991

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: OPAC 90-14
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 04/90

PROJECT TITLE:
Biological Control of Grey Mold in Strawberries

SHORT TITLE:

PRINCIPAL INVESTIGATOR AND AFFILIATION:
J.C. Sutton
University of Guelph

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OBJECTIVE(S):
To evaluate biocontrol agents for effectiveness in suppressing grey mold fruit rot of strawberries in the field. To screen additional isolates of fungal species show to be effective in biocontrol. To quantify effects of weather variables on the population dynamics of biocontrol agents applied to strawberries and on their effectiveness in suppressing grey mold. To develop systems to apply and time applications of biocontrol agents.

PROJECT DESCRIPTION: To develop biological control as an alternative to fungicides for managing grey mold fruit rot of strawberries. Organisms in advanced stages of screening as biocontrol agents will be evaluated in field plots. Effects of weather factors on population densities of the biocontrol agents in strawberry plants and on effectiveness of the agents in suppressing grey mold will be determined. These and other observations will be used to develop a system to optimize biocontrol through appropriate timing of applications of the biocontrol agents.

BUDGET AND RESOURCES:

YEAR: (* current)	1	2*	3	TOTAL
COST: ($000.s)	22.0			22.0

BUDGET SOURCE: OPAC TOTAL YEARS: 1.5

KEYWORDS:
grey mold fruit rot, biocontrol agents

OUTPUT (papers, presentation, reports):
OPAC Seminar 1991

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: OPAC 90-15
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 04/90

PROJECT TITLE:
Development of a Colour Trap to Detect and Monitor flies, Stobilomyia spp. infesting Coniferous Cones in Seed Orchards

SHORT TITLE:
Colour Trap to Detect and Monitor Flies

PRINCIPAL INVESTIGATOR AND AFFILIATION:
J.J. Turgeon
University of Toronto

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Dr. C.R. Harris
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OBJECTIVE(S):
Continue field-screening tests to determine the most attractive colour for traps located in trees to flies of Strobilomyia sp. Continue field tests to identify the position of the traps that is most effective in attracting flies before oviposition begins. Determine the level of sexual maturity of females caught on traps as a function of time as well as determine the exact period of oviposition in the site.

PROJECT DESCRIPTION:
To develop a colour trap to detect and moitor adults of cone maggots, by carrying out field experiments in Ontario with 3 cone maggots which develop in tamarack cones, and infest spruce cones. To obtain information needed to develop this traps we will assess their response to traps of different colours, hues, shapes and sizes as well as determine the influence of trap location and height within a stand on trap capture. The final step of this project will be to correlate trap catches with damage inflicted by these flies.

BUDGET AND RESOURCES:

YEAR: (* current)	1	2*	3	TOTAL
COST: ($000.s)	22.0			22.0

BUDGET SOURCE: OPAC TOTAL YEARS: 0.5

KEYWORDS:
cone maggots, tamarock cones and spruce cones

OUTPUT (papers, presentation, reports):
OPAC Seminar 1991

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X | CONTRACT: | SOLICITED: | PROJECT NO: OPAC 90-16
INTERNAL: | GRANT: X | UNSOLICITED: X | START DATE: 04/90

PROJECT TITLE:
Reducing Weed Competition in Corn Through Nitrogen Management

SHORT TITLE:

PRINCIPAL INVESTIGATOR AND AFFILIATION:
G. Hofstra
University of Guelph

LIAISON OFFICER (name,branch,section,address,telephone no.):
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OBJECTIVE(S):
To determine if the need for chemical weed control can be reduced by altering fertility regimes in corn. To compare weed species deversity and biomass under different fertility regimes in corn under organic and conventional practices. To relate weed species diversity to the level of nitrogen and nitrate in the soil. To compare weed establishment in the spring in plots treated with either turkey manure in the fall, followed by catch crops or with nitrate in the spring. To compare the effect of nitrogen supplied by a green manure crop with that supplied by nitrate on weed establishment in corn. To study the effects of different forms of nitrogen on weed seed germination.

PROJECT DESCRIPTION:
To develop a colour trap to detect and monitor adults of cone maggots, by carrying out field experiments in Ontario with 3 cone maggots which develop in tamarack cones, and which infest spruce cones. To obtain information needed to develop this trap we will assess their response to traps of different colours, hues, shapes and sizes as well as determine the influence of trap location and height within a stand on trap capture. The final step of this project will be to correlate trap catches with damage inflicted by these flies.

BUDGET AND RESOURCES:

YEAR: (* current)	1	2*	3	TOTAL
COST: ($000.s)	16.1			16.1

BUDGET SOURCE: OPAC TOTAL YEARS: 0.5

KEYWORDS:
nitrate, weed seed dormancy/germination, species diversity

OUTPUT (papers, presentation, reports):
OPAC Seminar 1991

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: OPAC 90-17
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 04/90

PROJECT TITLE:
Integrated Weed Management in White Beans

SHORT TITLE:

PRINCIPAL INVESTIGATOR AND AFFILIATION:
Dr. C.J. Swaton
University of Guelph

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OBJECTIVE(S):
To develop a weed threshold management model for post-emergence herbicide use in white beans. To compare the residual dissipation curves of metobromuron and bentazon in white beans grown under conventional management and integrated weed management system.

PROJECT DESCRIPTION:
Field research will be conducted to develo a computerized weed threshold management model for postemergence weed control in white beans. The first component of this research is to determine threshold levels of major broadleaf weed escapes during the critical period that result in yield losses. This study will refine our reduced-pesticide weed control system in white beans. The second component of this research will test the hypothesis that pesticide residues inbean seeds can be reduced or eliminated and weeds still effectively controlled if an IWM production system with reduced herbicide dosage and properly timed herbicide application is adopted.

BUDGET AND RESOURCES:

YEAR: (* current)	1	2*	3	TOTAL
COST: ($000.s)	16.0			16.0

BUDGET SOURCE: OPAC TOTAL YEARS: 0.9

KEYWORDS:
integrated weed management (IWM), white beans, post emergent herbicides/ efficacy

OUTPUT (papers, presentation, reports):
OPAC Seminar 1991

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: OPAC 90-18
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 04/90

PROJECT TITLE:
Interaction Among an Outbreak of Jack Pine Budworm, B.t. beneficial Lepidoptera Spruce Grouse, Amphibia, and Small Birds and Mammals

SHORT TITLE:

PRINCIPAL INVESTIGATOR AND AFFILIATION:
J.F. Bendell
University of Toronto

LIAISON OFFICER (name,branch,section,address,telephone no.):
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OBJECTIVE(S):
To complete the project begun in 1989, assessing the impact of operatinally spraying B.t. on wildlife and non-target Lepidoptera. To make direct observation of chicks in sprayed areas allotted to and brooded by Bantam Lens.

PROJECT DESCRIPTION:
We operationally sprayed two 40 ha plots of 20 year old Jack Pine with B.t., 30 BIU in 1.8 a/ha and measured the impact on wildlife, and arthropods of low shrubs, herbs and forest floor. Preliminary analysis suggest the B.t. decreased number of three foraging song birds, chicks of Spruce Grouse, and caterpillars of low shrubs and gerbs. Masked Shrews and American Toads were unaffected. Many data remain unanalyzed: 201 sweep net and 664 pittfall samples of arthropods, census data on song birds and grouse; and 150 measurements of growth and contents of 40 crops of chicks of grouse.

BUDGET AND RESOURCES:

YEAR: (* current)	1	2*	3	TOTAL
COST: ($000.s)	16.5			16.5

BUDGET SOURCE: OPAC TOTAL YEARS: 1.6

KEYWORDS:
Jack Pine Budworm, beneficial Lepidoptera, Spruce Grouse, Amphibia

OUTPUT (papers, presentation, reports):
OPAC Seminar 1991

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X | CONTRACT: | SOLICITED: | PROJECT NO: OPAC 90-19
INTERNAL: | GRANT: X | UNSOLICITED: X | START DATE: 04/90

PROJECT TITLE:
Optimization of Pathogen - Parasitoid interactions for Integrated Management of Eastern Spruce Budworm, Choristoneura fumiferana

SHORT TITLE:

PRINCIPAL INVESTIGATOR AND AFFILIATION:
K. van Frankenhuyzen
Bacterial Pathogens

LIAISON OFFICER (name,branch,section,address,telephone no.):
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OBJECTIVE(S):
To develop a solid experimental basis for a spruce budworm population managment strategy by testing hypotheses regarding the interaction between Bacillus thruingiensis, parasitoids, and budworm performance. Laboratory experiments will be conducted to further investigate interactive effects between B.t. and parasitoids, building on our previous work and to quantify carry-over effects of B.t. on budworm population quality. Laboratory observations will be complemented with observations from a field trial, designed to test the hpothesis that a properly-timed B.t. application can result in foliage protection as well as population suppression by enhancing effectiveness of parasitoids and debilitating budworm fitness.

PROJECT DESCRIPTION:
Recent progress in spruce budworm research indicates the possibility of developing a population management strategy by integrating our knowledge of microbial control agents with that of the population biology of the budworm and its natural enemies. We propose to develop the experimental basis for a population management strategy based on optimization of parasitoid-pathogen interactions. Experiments will be conducted to examine interactive effects between B.t. and parasitoids on survival and performance of spruce budworm in the laboratory, and to test results of laboratory experiments in the field by aerial treatment of high density budworm populations.

BUDGET AND RESOURCES:

YEAR: (* current)	1	2*	3	TOTAL
COST: ($000.s)	16.0			16.0

BUDGET SOURCE: OPAC TOTAL YEARS: 0.8

KEYWORDS:
pathogen-parasitoid, integrated management, eastern spruce budworm

OUTPUT (papers, presentation, reports):
OPAC Seminar 1991

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)

RESEARCH AND TECHNOLOGY INVENTORY: 1991

EXTERNAL: X	CONTRACT:	SOLICITED:	PROJECT NO: OPAC 90-20
INTERNAL:	GRANT: X	UNSOLICITED: X	START DATE: 04/90

PROJECT TITLE:
Response of Soil Microfauna, Microflora and Structure to Agricultural Practices in Corn, Soybean and Cereal Rotation

SHORT TITLE:

PRINCIPAL INVESTIGATOR AND AFFILIATION:
A.D. Tomlin
University of Ontario

LIAISON OFFICER (name,branch,section,address,telephone no.):
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OBJECTIVE(S):
To measure soil microfaunal, microfloral and soil physical properties in response to these treatments. Visual observations clearly indicate changes in soil structure, under continuous herbicide treatments, presumably related to faunal, floral and microfabric changes we hope to identify. An adjacent experiment beginning at Harrow in 1990, will compare reduced herbicide treatments in conjunction with tillage and crop rotation for weed control in soybeans, providing us with the additional opportunity to compare tillage effects on soil biota and soil structure.

PROJECT DESCRIPTION:
Evaluation of the effects of herbicide treatments, crop rotations, and tillage practices on soil biota and soil structure using currently and newly established plots at North wooodslee Stn. (Harrow Res. Stn.). Soil textures also will be mapped at the site in 1990 to measure soil heterogeneity in preparation for subsequent soil faunal, floral and soil porosity measurements in relation to the main treatment effects.

BUDGET AND RESOURCES:

YEAR: (* current)	1	2*	3	TOTAL
COST: ($000.s)	14.7			14.7

BUDGET SOURCE: OPAC TOTAL YEARS: 1

KEYWORDS:
herbicides effect on soil structure, microflora, corn, soybean and cereal rotations

OUTPUT (papers, presentation, reports):
OPAC Seminar 1991

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g. RAC, OPAC, Branch, etc.)